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SCIENTIFIC PROGRESS.
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THE EDISON MACHINE WORKS

SCHENECTADY, N. Y.,

MANUFACTURERS OF

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Flexible Cords and Cables,

— FOR —

TELEPHONE, TELEGRAPH and ELECTRIC LIGHT.

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ELECTRICAL REVIEW

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A WEEKLY JOURNAL OF

Electric Light, Power, Telephone, Telegraph and Scientific Progress.

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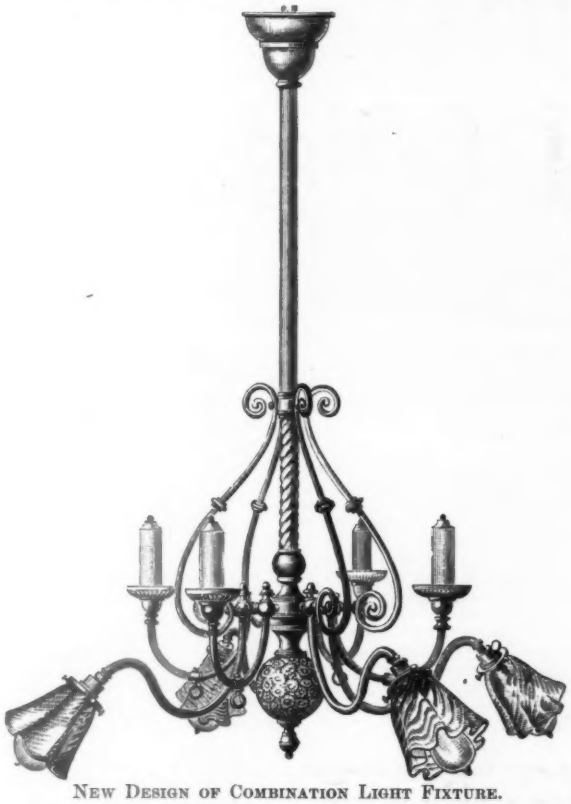
New Electric Fixture Design.

A new design of combination gas and electric light fixture is illustrated on this page, the artistic work of the Mitchell Vance Company, New York. It is specially adapted for use where the electric current is in use a part of the twenty-four hours, as the form of the electric arms give the best showing for the incandescent lamps, and the gas being arranged to burn in imitation candles and not with globes, renders the subordinate gas lights unobtrusive, and enables the presentation of a more artistic design for the incandescent electric lighting. This company is bringing out a number of new and attractive designs.

Arc Lights to be Nine Feet High.

The New York Board of Electrical Control met last week.

A regulation was adopted requiring all electric light companies, and not already acted upon, be revoked, and that the Commissioner of Public Works be notified that there are at present no permits extant, and that no further works are to be undertaken until he hears from this Board.



NEW DESIGN OF COMBINATION LIGHT FIXTURE.

electric arc lamps to be nine feet above the sidewalk, or if indoors, eight feet above the floor.

Mr. Gibbens put in a resolution directing the removal of wires to conduits in Broadway from Fourteenth to Thirty-fourth streets, and in Sixth avenue from Eighteenth to Fifty-eighth streets. The subways had been ready for two years, he said, and he had no doubt the Board would be supported by the Mayor.

"Has the Commissioner had an interview with the Mayor lately?" asked Mr. Hess.

"I listened to him for an hour and a half the other day," said Mr. Gibbens, evasively.

"That's more than he would have done for you," said Mr. Hess, and then everybody laughed.

The following resolution was adopted:

That all permits heretofore granted to your next issue, all the information of which you may be possessed concerning such award; and if it has not been made yet, please to watch for it or for information relating to it in the European exchanges or periodicals, so as to publish particulars in your paper as soon as you will get or find them.

AN OLD SUBSCRIBER.

New York, Sept. 13th, 1888.

The Volta Prize.

TO THE EDITOR OF ELECTRICAL REVIEW:

On the 1st of last December there was to be awarded in Paris, by the Minister of Public Instruction of France, an international prize called "Prix Volta" for the best work on "The Best Practical Application of Electricity to any Branch of Industry."

As far as the 11th of last May, the award, positively, had not been made. Has it been made since?

As the subject falls within the province of your publication, considering that it may be of interest to some of your readers as well as to myself, would you not kindly give us, in

Chased by a Thunderbolt.

"What was the fastest time you ever made?" asked The Talker of the Omaha *Herald* of Johnny Byers, one of the best known engineers in the Western country.

"Well," he returned, "I reckon a run of forty miles I made on the North Platte end of the division was the slickest. You see, I was sent out from Omaha with a light engine to pull in a special director's car from North Platte, and when I got within about fifty miles of the latter station I was given an order to run regardless of everything—other trains were side-tracked for me.

"I hadn't left the station more'n five minutes before a heavy thunder storm came up—they do it awful quick out there—and me and my fireman enjoyed the finest display of fireworks you ever see.

"All of a sudden Tom yells to me:

"'Holy Moses! The lightning's struck the track! Pull out, Johnny, or we're done for!'

"I looked back, and sure enough there came a streak of lightning along the right rail headed for us. It was a kinder whitish-blue sort of thing, and was humping along like it had a time order.

"I knew that if it struck the machine we was all gone to the sweet hereafter, and I pulled her wide open.

"Well, the old machine seemed to know something was up, and she gave a jump like a scared antelope and off ahead of that lightning streak. At first the streak seemed to be gaining on us, but after the engine got good and started, my, you ought to see the distance play out between us. But the lightning didn't seem to be discouraged. It just spit on its hands and clawed along after us like a promissory note after an insolvent debtor.

"Well, I saw something must be done, but couldn't make out how to do it. It was plain that if this thing kept up much longer the water and coal would give out, not to speak of red-hot journals. I says to Tom:

"'Heave away, now, with the coal and we'll fool him,' and although he'd been heaving away since the start of the race, that seemed to help, for I could see the lightning was lagging. Then I turned the machine over to him and crawled back on the tank. I had an idea. There was a siding a few miles ahead, and if we could make it—well, you'll see. There was a broken drawbar on the tank, and when I reckoned we'd got about the right distance I dropped it. I could see it rolling along for quite a distance, then I got back to the engine and slacked up.

"All of a sudden I heard the most outlandish racket you ever heard of behind us. Then the air was full of splinters, and when I rolled back, sure enough the drawbar had fallen in the switch I'd calculated on hitting, and had made such a connection with the main track that the lightning had been switched off and had run down on the siding and into two cars of powder standing there. I'm sorry I can't give you the exact time of that run, but under the circumstances you couldn't expect a man to hold a watch, now could you?"

The Cowles Aluminium Process in England.

In a recent issue of *Industries*, the works of the Cowles Aluminium Company at Milton, England, were described. The process of manufacture may be broadly divided into three heads: (1) The reduction of the aluminous ore; (2) the refining of the alloy produced in the first instance; and (3) the subsidiary process of preparing the materials for the electric furnace, and recovering certain waste products. The actual process of reducing the ore in the electric furnace is by far the most important, and requires nearly the whole of the steam power available. The main engine, which is used exclusively to drive the dynamo supplying current to the furnaces, is a fine compound condensing horizontal tandem engine, and was made by Messrs. Pollit & Wigzel. It is provided with automatic expansion gear, and the centrifugal governor is set to maintain the speed at 76 revolutions. The work on the engine is necessarily subjected to rapid fluctuations, and notwithstanding this circumstance, the governor appears to have perfect control of the speed. As an additional precaution against "racing," should the load be suddenly thrown off and the governor become accidentally disabled at the same time, there is an electrical device for stopping the engine automatically if the speed exceeds a certain limit. The engine can also be stopped from various points in the engine and furnace houses by pressing a push button. These push buttons are all connected in parallel with a main circuit leading to one of Tates' patent electric stop valves. On the spindle of the stop valve, which is provided with the usual screw and hand wheel, is fixed a steam piston working in a cylinder containing normally high pressure steam on both sides. The communication between the two sides of this piston is controlled by a small steam valve, which in its turn is controlled by a spring held off by a trigger. The trigger is connected with the armature of an electro-magnet, and upon completing the circuit by pressing a button in any part of the works, the spring is released, the auxiliary valve establishes communication between one side of the piston

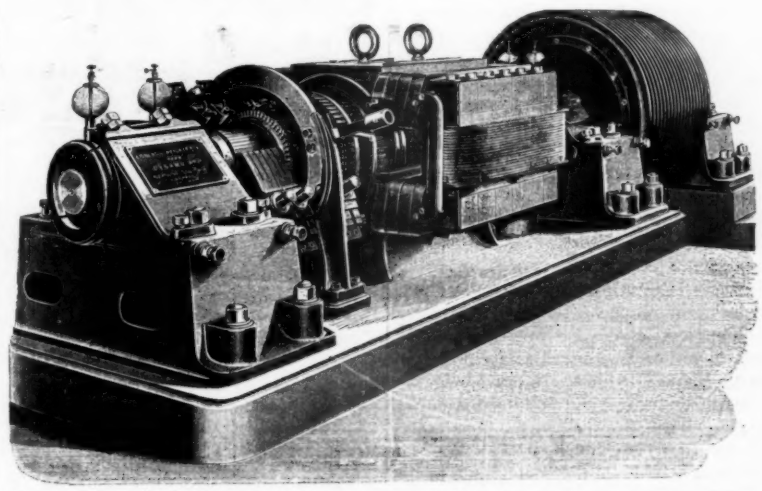


FIG. 1.—THE 400 H. P. CROMPTON DYNAMO, IN USE AT THE COWLES ALUMINIUM WORKS, ENGLAND.

and the condenser, whilst the steam on the other side forces the piston down and the valve on to its seat, thus bringing the engine to rest. The engine has a 23-inch high pressure and a 43-inch low pressure cylinder. The stroke is five feet, and at the time of our visit, says *Industries*, the steam pressure was 75 pounds. The fly-wheel is 20 feet in diameter, and weighs 30 tons; it is provided with 18 grooves for as many ropes, by which the power is transmitted to a 4-foot rope pulley on the dynamo.

The dynamo, illustrated in Fig. 1, was manufactured by Messrs. Crompton, and is said to be the largest machine in England. It has been designed for an output of 5,000 amperes at 60 volts pressure, when running at 380 revolutions per minute. It is a very compact and handsome machine of the horizontal double horseshoe type, and has a drum armature wound with bars of naked copper, insulated from the core and from the driving horns by mica. The end connections are made according to a method patented by Mr. Swinbourne. The section of conductor is $\frac{3}{8}$ inches by $\frac{7}{8}$ inches, and there are 128 bars when counted all round the armature, and these are connected with 64 commutator strips by screws, no soldering being used. It will interest electricians to learn that this method of connection, which is adopted also in other parts of the machine, has proved perfectly reliable, notwithstanding the fact that the machine occasionally carries 6,000 amperes. The bars are placed edgeways on the core, and are connected in groups of four, so that the winding is electrically equivalent to an armature having 32 external conductors and 16 commutator strips. The sub-division of each conductor into four has been adopted in order to reduce as much as possible the tendency to heating from eddy currents, which, with a conductor $1\frac{1}{2}$ inches wide, would be excessive. Even with this subdivision there is still a certain amount of heating, but this is quite within safe limits. The machine works now almost continuously night and day, and what heat there is generated by eddy currents and resistance, is carried off by an air blast from a Schiele fan.

The machine, when seen at work, gave about 5,000 amperes at a pressure of 60 volts; but occasionally the current would rise as high as 6,000 amperes. The core of the armature is 20 inches diameter by 36 inches long. The magnets are 37 inches by 6 inches cross section, and compound wound, with the main preponderating. The machine is almost a series dynamo pure and simple; but a shunt has been added to facilitate the starting, when, with the furnace cold, the resistance in the external circuit is necessarily large. As will be seen from the illustration, the shunt coils are wound on the yokes, and the series coils on the horizontal limbs of the magnets, there being four turns on each limb, but only three of them in circuit. Each shunt coil contains 250 turns, and the shunt current is about 50 amperes when in regular work. In the furnace house there is a rheostat, by which the furnace men can, within certain limits, vary the shunt current and the pressure given by the machine, and to facilitate quick starting there is a switch on the dynamo by which the two shunt coils can be placed into parallel. The main coils are all in series, and the total exciting power when in regular work is therefore about 42,000 ampere turns. The current is taken off by four brushes on either side. These brushes are attached to the large ring, clearly shown in our illustration, and by means of a long bar placed into the socket, also shown, a man keeps the brushes during the run to the non-sparking point. The smaller ring surrounding the commutator serves as a strengthening piece to the sections, which, owing to their great length, require some additional support. The driving power is transmitted to the armature conductors by 48 driving horns of aluminium bronze. The current coming from the dynamo is led by copper bars to an enormous cut-out, and from there to the furnaces in the adjoining room. A huge current indicator is inserted into the circuit, in order to enable the attendants at the furnace to judge of the progress of the operation, and to keep the current within certain limits, by adjusting the distance between the electrodes. The current indicator is simply a solenoid of nine turns through which the current passes, and into which is placed an iron core suspended from a spring. The movement of the core is made visible by a pointer playing over a large dial, and the axis of the pointer is carried through the wall, so that the indications are repeated on a second dial in the engine room. The electrodes can be withdrawn or advanced by means of a screw and handle, and a boy on each side of the furnace watches the current indicator, and manipulates his electrode so as to keep the current as uniform as possible. The construction of the furnaces is exceedingly simple. Each furnace is a rectangular pit, constructed of fire clay, and provided at either end with an inclined cast iron pipe, through which the electrode is introduced, as will be seen on reference to the illustration, Fig. 2, which represents a nest of furnaces in one of the furnace rooms. The current is supplied by the two copper bars running horizontally across the furnaces, and by flexible cables, which can be clamped to the bars in any desired position. Only one furnace is running at a time, the other furnaces being meanwhile either charged or left to cool. Each electrode is a bundle of from seven to nine carbons (each two and a half inches diameter), round which is cast a cylindrical head of iron when ferro-aluminium is to be produced, or copper when aluminium bronze is to be produced. A stout copper rod is attached to the center of the head, and projects through the cover of the cast iron pipe already mentioned, and to the outer ends of these rods are clamped the flexible cables pending from the omnibus bars overhead. The furnace is charged as follows: On the bottom is thrown a layer of limed charcoal; the electrodes are then inserted, and two pieces of sheet iron connected by stirrups, and forming the sides of a bottomless box, are then put in to serve as a temporary receptacle for the charge of ore, metal, and charcoal, whilst the spaces between the sheets of iron and the longitudinal walls of the furnace are filled with charcoal, after which the sheet iron box is withdrawn. To start the current a few broken pieces of carbon are thrown into the furnace so as to bridge across between the electrodes, and the whole charge is then covered with a top layer of charcoal, and the furnace is closed with a cast iron cover provided with a hole in the center, through which the gases generated during the process escape. These gases are ignited, and burn with a white or slightly purple flame. At first, and shortly after turning on the current, the gases given off are mostly hydrogen and oxygen; but when all the water has bean driven off, the combustible gas is chiefly carbonic oxide, the carbon being supplied by the charcoal and electrodes, and the oxygen coming from the ore. With careful manipulation, one pound of contained aluminium can be produced for every three pounds of the ore used.

By the intense heat in the center of the furnace, the reduced aluminium and the alloying metal—iron or copper as the case may be—are volatilized, and the ascending vapors become condensed in the upper and cooler layer of charcoal. They are here so intimately mixed as to form nearly or quite a true chemical compound, the liquid alloy running back in rivulets, and collecting at the bottom of the furnace. A "run" usually lasts an hour and a half. The furnace is then left to cool, and the current is laid on to the next furnace, which had previously been charged.

Thus the operation is a continuous one, going on night and day. Sometimes the cooling is accelerated by playing into the furnace with a water hose. During the run a certain small quantity of aluminium escapes with the gases by the hole in the furnace cover, and to save this a pipe is placed over the hole, which carries the products of combustion up into a settling tank overhead, from whence the fine dust of aluminium oxide is periodically collected and charged again. The spectroscope shows, however, no aluminium lines when the flame is examined, which is due to the comparatively low temperature of the flame. The lithium band, on the other hand, is strongly marked.

It is both interesting and important to note that the addition of aluminium to iron alters its magnetic properties; the more aluminium there is present the less magnetic is the alloy, until with about 17 per cent. the "ferro" becomes non-magnetic. This quality of the alloy is made use of at the works for roughly sorting the product by a simple magnetic test, the men with a little practice becoming quite competent to determine the percentage of contained aluminium with a fair degree of accuracy. The company do not, however, rely entirely upon the magnetic test, as there is a well appointed laboratory, where all the alloys produced are chemically analyzed, as in other metallurgical works. There is also a mechanical laboratory containing a 30 ton testing machine, by which the tensile and transverse strength, elongation, and elastic limit of the alloys are determined.

The manager at the works states that, owing to the various improvements and simplifications introduced, the Cowles electric process produces aluminium alloys at very greatly lower cost than claimed by any other process. By a further improvement, now being carried out, the cost of manufacture can yet be further lowered. This improvement consists in the adoption of a tap furnace, in which the alloy, as it is formed at the bottom of the electric furnace, is drawn off in a pure state through a tap hole, very much as in a cupola. Such tap furnaces have already been erected, and have been for the last three months practically at work night and day in the Cowles Company's Works at Lockport, New York, and it has been found possible to very materially reduce the cost of manufacture by this means. The electrical energy required for the production of one pound of contained aluminium, varies of course with the grade of the alloy. For very high grade alloys it is 15 horse-power hours, and for low grade alloys it may rise to 30 horse-power hours, the average being about 22 horse-power hours.

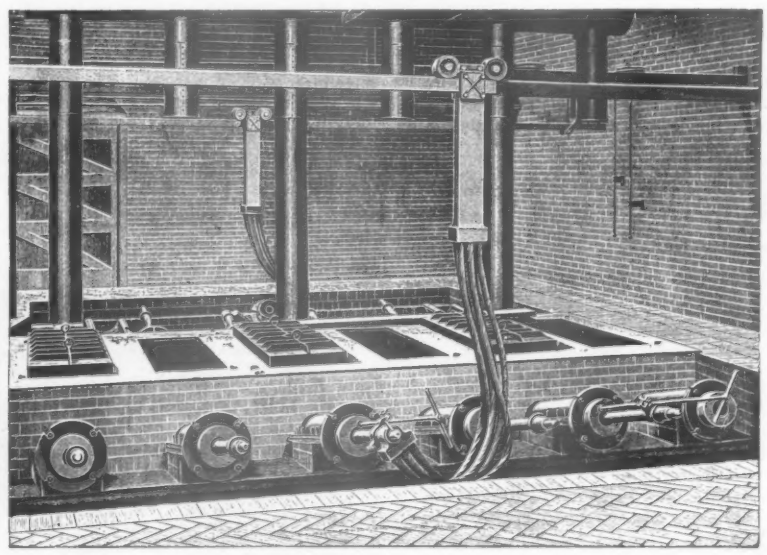


FIG. 2.—VIEW OF THE ELECTRIC FURNACES.

A Storage Battery Company in St. Louis.

The Electrical Accumulator and Lighting Company, of St. Louis, has just been organized and will immediately begin the erection of a 10,000 electric light plant, under the accumulator storage battery system. The company will have a capital stock of $250,000. It has been in process of organization for the last two months, but the scheme was kept very quiet until all the parties were gotten into it. The parent company is the Electrical Accumulator Company, of New York, and the local companies already established are in New York, Michigan, Illinois, Missouri and the East. The St. Louis company's territory, for which it has exclusive license, consists of Eastern Missouri, Southern Illinois, Arkansas, Texas and Louisiana, and it proposes to introduce this class of electric lighting throughout the territory.

—— The Southern Pacific R. R. Company have bought a combined arc and incandescent plant made by the Waterhouse Electric and Manufacturing Company, of Hartford, Ct. It will be used for lighting their station at Los Angeles, Cal.

The U. S. Torpedo Station at Newport.

That interesting portion of the United States Navy known as the torpedo station was established on Goat Island, in the harbor of Newport, in the summer of 1869, occupation of the island by the Navy Department being authorized by the Secretary of War on July 29th of that year. This island, the Indian name of which is "Nanti-Sinonk," was purchased from the Indians May 22, 1658, and was subsequently sold to the Colony of Rhode Island and Providence Plantations by Benedict Arnold.

In 1701, the Assembly voted £150 for the building of a fort on the island, naming the work Fort Anne. In 1730, it became Fort George. In 1774, the Assembly ordered Fort George dismantled and the guns sent to Providence for safety. During the War of the Revolution it was called Fort Liberty by the Americans, although the English, during their occupation of Newport, retained the old name of Fort George. In 1784, it was named Fort Washington, and, in 1798, Fort Wolcott, to commemorate the Revolutionary service of Governor Oliver Wolcott.

During the War of the Rebellion Goat Island was occupied by the Naval Academy. Two frigates, the "Constitution" and the "Santee," were moored near the shore, and were used as quarters for midshipmen.

At the time of the founding of the torpedo station, there were on Goat Island a one-story building, formerly the army barracks, and a number of small wooden structures, which had been erected for the use of the Naval Academy. The barrack building was utilized for class rooms for officers, and for laboratories. What is known as Storehouse No. 2, built principally of the material obtained from the temporary buildings first mentioned, was used as a storehouse and machine shop. Between 1871 and 1874, the station experienced its greatest material expansion, the storehouse, the machine shop, the cottages for officers, the chemical laboratory and the electrical laboratory being erected, and the old barracks rebuilt into quarters and offices for the inspector in charge.

The only notable addition since that date is the gun-cotton factory built in 1881 and the new wing of the electrical laboratory just completed.

The torpedo station was instituted with the view of training a number of officers and men (to be entitled the torpedo corps) in the use of torpedoes of all kinds and the necessary accessories.

It was intended that to this place, as headquarters, should be confided the defence by torpedoes of our entire coast. Two years later, by congressional action, the general subject of torpedoes was divided and that part relating to stationary torpedoes (called submarine mines) was assigned to the Engineer Corps of the Army.

From the moment of its inception the torpedo station has been occupied with the experimental solution of a great variety of technical problems effecting the naval service.

Of the various forms of torpedoes devised or tested at the station there is no end. The spar torpedo, operated from launches or even larger craft, has been studied and perfected in all its parts. From the cumbersome cast iron shell filled with gunpowder has been evolved the small and compact sheet iron case carrying gun-cotton of more than double power.

Explosion by percussion has given place to explosion by means of electricity either on contact or at will.

For wooden spars have been substituted iron and steel tubes. The present boat fittings will probably remain practically unchanged for a long while to come.

The towing torpedo, a case designed to be dragged by a cable off the quarter of a vessel and to dive underneath an adversary, received at one time much attention and experiment. It had its day and is now obsolete.

Stationary torpedoes being soon transferred elsewhere are only dealt with here as a means of instructing the officers and men in the nature of the obstructions they are likely to encounter in an enemy's port. They are anchored in the channel, usually connected with the shore through submarine cables, and fired by electricity when struck by a ship striving to force her way in. Prior to their removal to Willett's Point, many appliances for their use were invented or improved here. It will suffice to refer to the indicator and cut-out (designed by Lieut. Comdr. Converse), an instrument which is mounted on shore and which rings a bell to call the attention of the operator whenever the cable leaks or the circuit is broken, and which fires the mine when struck, at the same time showing on a dial the number of the mine exploded and breaking, for a moment, the circuits of all neighboring mines which might be fired through the commotion of the water.

Another form of torpedo is known as the "controlled torpedo." It carries its own motive power, is propelled by an engine and steered from the starting point by electricity. The exemplar is the Lay, so called after its inventor, of which three specimens

have been tried at the station. Mr. Ericsson has also entered this field and sent here a torpedo driven and controlled by compressed air conveyed through a flexible tube which is dragged by the torpedo.

The Whitehead torpedo, adopted by all the navies of the world, except our own, is self propelled, but it is not controlled. It runs at a set depth below the water and must be launched in the right direction to insure a hit. An experimental torpedo of the same nature was planned and constructed here in 1870. Of like type and scope are the Howell and the Hall torpedoes, the one driven by the energy stored up in a heavy revolving disc, the latter, like the Whitehead, by compressed air.

It was through the torpedo station that electricity was introduced into the navy. The apparatus for test and experiment is quite complete, including steam generators and engines, dynamos of various makes, and a tolerably well equipped electrical laboratory, to which heavy currents are conveyed by adequate underground conductors.

The whole station is lighted at night with electricity, produced by a large compound-wound Weston dynamo driven by a Westinghouse automatic engine. The ferry launch "Wave" is lighted electrically by a small turbo-electric generator making 9,000 revolutions per minute.

Our navy is very deficient in torpedo boats. The hull of the first of its kind is still at the torpedo station. This boat, the "Lightning," was built by Herreshoff in 1876. Her performance of over 20 miles in an hour has never been equalled by a boat of her size—58 feet in length. The "Stiletto" has lately been added to the fleet.

The use of high explosives in naval warfare has been the constant object of experiment. Nitro-glycerine, dynamite, explosive gelatine, etc., have been made and tested, and much valuable information brought before the public. On Rose Island, in the middle of Narragansett Bay, is a battery of light guns, where explosives for use in shells are tried in small quantities before passing to the proving ground, at Annapolis, for experiment on a large scale.

The torpedo station has three distinct functions—experiment, manufacture and instruction. It assembles the parts of all torpedo outfits for vessels—although castings, etc., are secured from outside establishments. Its activity in this respect, at any time, depends upon the number of vessels fitting for sea. In addition, it manufactures all the gun cotton used in the navy. The plant for this purpose was erected in 1881, and is the only regular factory in the country for the manufacture of this wonderfully safe and powerful substance.

Every year a number of naval officers are ordered to the torpedo station for three months' instruction in torpedo work, diving, electricity, high-speed engines and the chemistry of explosives. Practice dominates this course, and theory only enters so far as is necessary. A few members of each class return subsequently for a more extended course of instruction in the same branches.

Two classes of seamen are practically trained here each year in these subjects. The same men receive six months' additional training in the gun shops of the Washington Navy Yard, and are rated seamen gunners. From among their number are selected the specialists of the crew to care for the new appliances of warfare, such as modern guns with their complicated carriages and gear, rapid fire guns, gatlings, dynamos for ship lighting, search lights, electric motors for pointing the guns, etc., etc.

In general terms, nearly all new appliances, outside of propelling machinery and ordnance proper, pass through the torpedo station for criticism or test prior to adoption into the naval service. As a technical and experimental laboratory for the navy its value is great and constantly increasing.

A number of electrical gentlemen, who had been clam-baking with the American Electrical Works, visited the station recently and spent a pleasant and instructive hour visiting the points of interest, and listening to the entertaining remarks of Chemist Chas. E. Munroe, in relation to high explosives. The visitors were shown every attention by Lieut. Comdr. G. A. Converse, P. A. Paymaster F. H. Clark, and others of the officers.

The *personnel* of the torpedo station is as follows:

Commander C. F. Goodrich, Inspector of Ordnance in Charge of Station.

Lieutenant Commander G. A. Converse, Principal Assistant Inspector of Ordnance, Instructor in High-Speed Engines.

Lieutenant Karl Rohrer, Assistant Inspector of Ordnance, Superintendent of Gun-Cotton Factory.

Lieutenant G. F. W. Holman, Assistant Inspector of Ordnance, Instructor in Torpedoes.

Lieutenant Hamilton Hutchins, Assistant Inspector of Ordnance, Instructor in Electricity.

Surgeon John C. Wise.

P. A. Paymaster F. H. Clark.

Prof. Charles E. Munroe, Chemist to Torpedo Corps.

The Waterhouse Automatic Regulator.

In Fig. 1 is represented a diagram of the Waterhouse type of dynamo, with a closed circuit armature, *A*. On the commutator, *C*, are three brushes; *a* and *b* are the main circuit brushes, and *c* the auxiliary brush. From the positive brush, *a*, the current passes on the conductor around the field magnets, *F*, to the resistance, *R*. The current from the auxiliary brush, *c*, passes directly to resistance, *R*, leaving the field magnets out of circuit. The current from both circuits (field and local) joins at *R*, and pass to the lamps, the current on the lamp

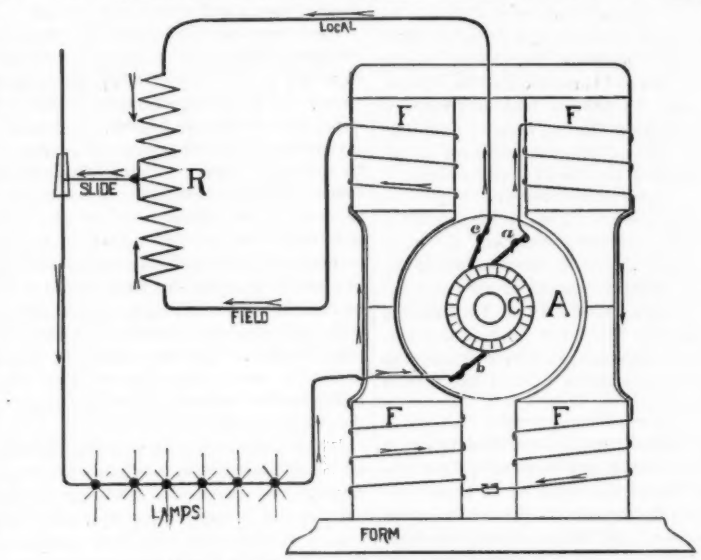


FIG. 1.—DIAGRAM OF WATERHOUSE DYNAMO.

line being the sum of the two. The amount of current in the field and local circuits is in proportion to the resistance, *R*, in each. The brushes have a fixed position.

There is in every dynamo a point of maximum commutation on the armature, which changes with the resistance on the lamp line, moving with the rotation (towards brush *c*) when the resistance decreases and back when it increases. This affects the current in the local and field circuits, as follows: When lights are turned out the line resistance is decreased, and the maximum point moves forward and forces more current out of brush *c*, and less out of brush *a*. This reduces the current in the field magnets and the E. M. F. of the circuit, and consequently the power required to operate the dynamo; but the current on the lamp line remains constant because the local circuit is increased proportionally to the decrease of the field circuit. The remaining lamps therefore retain their full brilliancy, while the current cannot increase and destroy the apparatus. Thus the very tendency of the machine is to perfect regulation without the aid of a mechanism, but when to this is added the simple regulator, which makes the regulation instantaneous by assisting the current to pass out at brush *c*, and opposing its passage around the field magnets by way of brush *a*, when lights are cut out, and forcing it out at brush *a* around the field magnets by opposing its passing out at brush *c* when lights are cut in, the efficiency of the method can be appreciated.

The regulator is illustrated by the slide in the form which is controlled by a solenoid. Any tendency of the current to increase raises the slide (see slide, Fig. 1) and the result is a decrease of resistance in the local circuit and an increase of the resistance in the field circuit. More current will, therefore, flow through the local circuit and less through the field circuit. The generating capacity of the dynamo is instantly reduced, and any tendency to produce a current above the standard is overcome. Should the tendency of the current be to decrease, say by a reduction of the speed of the armature, the slide lowers, increasing the resistance in the local, and reducing it in the field circuit. More current will then flow around the field magnets and less out on the local circuit. The generating capacity of the dynamo will, therefore, increase to maintain the current

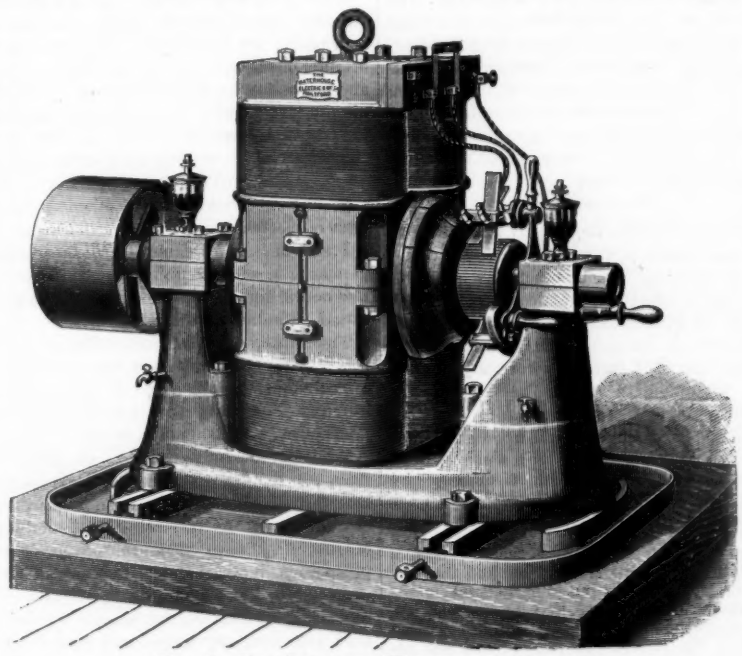


FIG. 2.—THE IMPROVED WATERHOUSE DYNAMO.

at standard. It should be stated that the use of resistance for balancing the field and local circuits is a small amount compared to that used by the lamps and is not interposed as can be seen for the purpose of compensating for lamps turned off.

The regulator is applied to the Waterhouse dynamo shown in Fig. 2, which has a closed circuit armature. This type of armature is most efficient.

The Waterhouse system has been in use two years and has passed successfully the experimental age, and is now regarded as one of the excellent systems of electric lighting.

Tecumseh, Neb.—The Tecumseh Electric Light Company has recently been incorporated with a capital stock of $10,000.

Easton, Pa.—The Edison Illuminating Company, of Easton; capital, $50,000; H. G. Lombler and others, incorporators.

Homestead, Pa.—The Homestead Electric Light and Power Company, of Homestead; capital, $10,000; Louis Roit and others, incorporators.

Galena, Ill.—The Galena Electric Light Company; capital, $10,000; incorporators, John A. W. Mensell, August Heid, and Benjamin Franklin Mensell.

Chicago, Ill.—The Chicago Electric Light Enlarging Company, of Chicago; capital stock, $5,000; incorporators, Adolph Graeff, Alfred Graeff, and E. Graeff.

Chicago, Ill.—The Merchants' Arc Light and Power Company, of Chicago; capital stock, $30,000; incorporators, William H. Collins, Joel W. Stevens, and Benj. Keigher.

East St. Louis, Mo.—The American Gear Forging Company, of East St. Louis; capital stock, $100,000; incorporators, O. Navius, Arthur W. Billings, and William S. Long.

Chicago, Ill.—The United States Cold Bending and Coiling Pipe Company, at Chicago; capital stock, $250,000; for manufacturing; incorporators, G. W. M. Reed, G. H. Rozet, and J. W. Cotton.

Westchester, N. Y.—Articles of incorporation for an electric railroad between Port Chester, White Plains and Tarrytown have been filed in the Westchester County Clerk's office. The capital stock is $25,000.

Clinton, Ill.—The Clinton Electric Light, Heat and Power Company, of Clinton; capital stock, $25,000; incorporators, Vespansian Warner, Clifton H. Moore, John Warner, Abner R. Phares, and Richard Butler.

Chicago, Ill.—The Nutting Electric Manufacturing Company, of Chicago; capital stock, $100,000; for the manufacture of electric apparatus; incorporators, Samuel E. Nutting, W. H. Foulke, and J. W. Hefenburg.

Camden, N. J.—The Love Electric Railway Company, of Camden; capital, $1,500,000, divided into 30,000 shares, and with $1,200 paid in. The incorporators are: Thomas W. Thompson, James G. Lindsey, H. D. Fling, and B. F. Hart, of Philadelphia; and Albert H. Lennox, of Camden.

St. Louis, Mo.—The Ranken & Fritsch Foundry and Machine Company; capital, $150,000. The stockholders are: John D. Ranken, 570 shares; Bruno Fritsch, 570; W. H. Thomson, 114; Otto N. Von Schrader, 171; T. C. Whittemore, 20; Aug. Thury, 15; Christ J. Dorn, 25; and Henry Luehrsel, 15.

Albany, N. Y.—The Porter Teletype Company; capital, $200,000. The principal office will be in New York City. The company is to make, sell and lease electrical signals, alarms, etc. Anthony N. Brady, Albert L. Judson, of Albany; and Patrick T. Wall, William J. Harvey, and Henry A. Hayden, of New York, are trustees.

—— The Troy Fertilizer Company, of Troy, Ala., will put an electric light plant in their works.

—— The Burlington Gas Light Company, Burlington, Vt., have recently made quite an addition to their electric light plant. They purchased from the Brush Electric Company, Cleveland, Ohio, one 30 light 2,000 c. p. arc dynamo, with full complement of lamps.

ELECTRICAL REVIEW

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EDITORIAL ANNOUNCEMENT

Address all communications and make all Express Money orders, P. O. orders and checks payable to order of ELECTRICAL REVIEW, P. O. Box 3329, New York.

☞ No attention will be paid to communications without the *name and address of the writer.*

We invite correspondence from Electricians, Inventors, and the Telegraph and Telephone fraternity and those engaged in Electric Lighting, on matters pertaining to electrical and scientific subjects, and all facts of special interest in connection therewith.

We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.

Subscribers can at any time have the mailing address of their paper changed by sending both old and new address.

Timothy W. Sprague, Room 58, No. 178 Devonshire Street, is our representative at Boston, Mass.
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NEW YORK, SEPT. 29, 1888.

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A barbed wire "trust" is proposed. It should be sat upon.

The Electrical Society of Cincinnati has been organized, with A. R. Foote, president, Edgar A. Edwards, secretary, and C. E. Jones, treasurer. Meetings are to be held twice a month.

Improvements in telephone central office facilities continue, and we may yet see the automatic exchange. Then the telephone men should be happy, but what will the subscriber do if he can't complain of the operator?

Those were wise words of President Metzger, of the Telephone Association, urging improvement and cheapening of the service. Now that the trouble with infringers is ended, and their standing assured, telephone companies should earnestly endeavor to advance all along the line of improvements.

The large telephone poles on Sixth avenue, New York, are being removed, the wires having been placed in the conduits of the Subway Company. Some of the poles and wires belonging to the U. S. Illuminating Company were disturbed, and as a consequence the fight between this company and the Board of Electrical Control has broken out afresh.

Ex-Governor Cornell is reported in an interview as stating that the electric light current has caused the death of 11 persons in New York in the past two years. We think the Governor is mistaken. There have been five deaths in 10 years. We trust the Hon. Mr. Cornell is not knowingly falsifying for the sake of bolstering up his ancient, old fogyish, and particularly selfish ideas regarding electricity. He now has an opportunity to name or locate the 11 victims his affrighted mind has knowledge of.

The committee on judiciary, through Mr. Culberson, has reported to the House the bill to establish a Court of Patent Appeals, recommending its passage with amendments. The report speaks of the "incalculable advantage that will result to litigants in the Supreme Court from the saving of time," and calls attention to the following gratifying financial condition of the Patent Office: The income of the Patent Office for the fiscal year ending June 30, 1888, was $1,122,994.88; expenses, $953,730.14; leaving a surplus turned into the Treasury of the United States of $169,264.49, which, added to the previously credited surplus, makes a balance in the Treasury to the credit of the patent fund of $3,337,666.65.

Mayor Hewitt's thoroughly reasonable as well as logical position on the underground wire question, if for no other reason, should commend him to all practical men, and it is with no little satisfaction we observe that his chances for re-nomination are good. A man capable of forming a correct judgment on so difficult a question as that he was called upon to deal with, has a judgment and understanding of no mean order. Some of the public organs have insisted that all the wires should be buried, and that the best service must be given as well, though the air is the best and the ground the worst description of insulation. It would have been very easy for Mr. Hewitt, had he been a full-fledged politician, to demand that the wires be "instantly put underground"; that is the term, we believe, that has become popular, but, in the case of the high tension wires, Mr. Hewitt did not see how the ills complained of could be remedied by acquiescence in such a demand, and he refused to make it.

THE UNCERTAINTY OF IT.

W. H. Preece, F.R.S., the eminent electrical engineer of England, in an address before the British Association, in speaking of the substitution of electricity for hanging by the New York Legislature, said:

"Those who have assisted at this hasty legislation would have done well to have assured themselves of the practical efficacy of the proposed process. I have seen the difficulty of killing even a rabbit with the most powerful induction coil ever made, and I know those who escaped and recovered from the stroke of a lightning discharge."

A LESSON FROM A LOG CABIN.

The trite adage that politics make strange bedfellows was brought to mind on entering the Republican Club at Winsted, Conn., a few evenings ago. In remembrance of the Harrison campaign of 1840, a log cabin has been built in the central portion of the town for this political organization, but in order to fulfil its purposes, it has been brilliantly illuminated by electric lights. An electric light in a log cabin, bringing into juxtaposition the pioneer hardships of half a century ago, and the luxury of electric light which is deemed a necessity to-day, forms an anachronism which is certainly unique.

It represents a development of humanity bridged by fifty years of progress. As Lord Rayleigh said in his Presidential address before the British Association for the Advancement of Science in 1884, "a thousand inventions were necessary to make an incandescent lamp," so it might be added that ten thousand inventions were necessary to develop the demand for its use. The differences between the appeals to reason, and the able presentation of various theories of political economy by both parties in the conduct of this campaign, in comparison with the hilarious manner in which the elder Harrison was sung into the Presidency, is one of the signs of the times indicating the advancement of the mind of the general public.

In this half century of progress, electricity has advanced from a science to an art. Electric motors were a whirligig for the curious and a toy for royalty; now they form a well known method of transportation, and transmission of power to places where steam is forbidden to enter.

Wheatstone had produced the ingenious five-needle telegraph, and Morse was experimenting upon the system, which was one of the most perfect inventions ever set to do the service of man. Sir Humphrey Davy had exhibited the electric arc between carbons, but it was not until 1844 that Foucault had produced even the hand regulator.

Faraday had discovered induction, and Pixii had applied those principles to the production of the magneto-electric machine, but nothing approached the dynamo in the measure of its practical applications.

John Frederick Daniell had made the galvanic cell bearing his name four years previously, an invention which was the original of the present type of gravity cell, and possessing an importance hardly recognized to-day; and it was from the scaling of the copper in the Daniell cell that the first suggestions were derived for electro-plating by Jacobi, at St. Petersburg, at about 1840.

Even the earliest types of other applications of electricity were not in existence.

The year before Deguerre had succeeded in taking a sun picture in the course of a few hours, and no one dreamed of its application for animate objects.

The railways in the United States at the time, during their thirteen years since their introduction, had reached to only a few hundred miles, now they extend to a distance of over 200,000 miles in this country.

What is the only result to be deduced from all this progress in these inventions that form dutiful handmaids to humanity, other than that by increasing the functions of life, they have made the people more prosperous, increasing the measure of the capacities of life. The only result must be that the operations of the human mind extend over a broader scope, and that forms the highest ideal of an enlightened being.

Dr. A. V. Garratt, of Boston, editor of *Modern Light and Heat*, was a New York visitor last week. It is now his intention to accept the position of secretary and treasurer of the National Electric Light Association, and will soon move to New York.

The ever-artistic eye of Manager Patterson, of the Phœnix Glass Company, is not confined to the beautiful designs turned out by his large glass factory near Pittsburgh, but extends into the fruitful field of advertising. We think his new card in the REVIEW worthy of this special mention, and don't think any of our subscribers will neglect to read it.

OUR CHICAGO LETTER.

(Special Correspondence.)

As the fellow said who had yoked himself to a young steer to train it: "Head us, somebody." In the C. C. H. letter of last issue, the closing paragraph was misplaced. If the reader will imagine it removed so as to immediately follow the paragraph commencing with, "In connection with this each subscriber to the petition is asked," etc., there will be some sense apparent. As it stands, the writer's meaning is ambiguous, to say the least of it.

The Chicago Arc Light and Power Company's station at 406 N. Clark street, near Maple, was burned pretty thoroughly on the morning of the 10th. The dynamos stopped at midnight, exactly—the engineer left the room at 12.40, and the alarm was turned in at 1.19, but electricity was assumed by parties, who ought to have thought differently, to have been the incendiary.

The Excelsior Agency here, F. W. Horne "at the bat," has a large plant running at the Stock Yards, just south of the city. The plant is the property of the Stock Yards Company. Armour & Co. have a large Thomson-Houston arc plant, which is soon to be enlarged, and an Edison incandescent plant as well. The Brush people too are running, and the Western Electric Company also has plants within the Yards.

Horne, of the Excelsior Company, reports that the Metropolitan Electric Light Company, of St. Louis, has adopted the Excelsior system, and given an order for a plant of two 30 light machines and trimmings. Four steamboat plants have been ordered by Wm. Oswald, of New Orleans, for river service.

There will probably be a large and select convention of electric light people at or near the water works at Lake View, just north of Chicago, in a very few days, now, if not sooner. At the next meeting of the town council a proposition will be presented to build a tunnel 4,000 feet under the lake, and a crib for water purposes; and the crib is to be lighted by current from a dynamo at the shore end of the tunnel. All the boys will go. At the last meeting of the city council an ordinance was presented by Alderman Landon, giving the Chicago Telephone Company the right to run wires in conduits in the underground district, and upon poles outside that territory. The company offers to furnish telephones to the city public offices free of charge in consideration of the privileges asked, and to comply with other provisions of the old ordinance, which last has expired by limitation. The ordinance went to the Fire and Water Committee. The alderman thought the company should pay a license fee and be restricted to a maximum rental.

The License Committee held a consultation over the same question on the 13th. It was decided to recommend the passage of a resolution by the council directing the law department to take measures to dissolve an injunction obtained by the telephone company against the city in 1883 restraining the municipal authorities from cutting the overground telephone wires then strung or otherwise interfering with the plant of the telephone company. This injunction was allowed to stand by Mayor Harrison on the understanding that the telephone company would place all its wires within the business district in conduits from time to time. The understanding was not carried out. The committee further directed the corporation counsel to prepare an ordinance for the regulation of the Chicago Telephone Company, such a one as would protect the city's interests, and which would fix the annual rental at $75 per phone in accordance with a petition signed by over 3,000 renters which had been presented to the committee. The committee discussed the right of the council to fix the rental. The corporation counsel declined to express a decided opinion on this question.

The Morris, Ill., councilmen have been for some time wrestling with the fire alarm question. Finally, Mr. Chas. A. Rolfe, who is with Mr. E. B. Chandler, general western agent of the Gamewell Company here, captured the contract, one day last week, and will at once proceed to put in the apparatus,

consisting of six stations, one bell striker, the necessary gongs, and some four miles of wire.

Harvey L. Lufkin, of the C. & C. Motor Company, was discovered, the other day, sawing a hole in the floor of the Exposition building. What might otherwise have had a rather mysterious look, was explained by the fact that close by stood a two horse-power motor, which he was arranging to run a lot of sewing machines, and the hole was to bring a belt through from the shafting below.

Mr. George F. Porter, of the Faraday Carbon Company, as well as Mr. Lufkin, and Mr. C. M. Ransom, of *Modern Light and Heat*, were callers at the Club during the week. Mr. Ransom was in attendance at the annual meeting of the Northwestern Underwriters' Association

Wm. H. Collins, Joel W. Stevens, and Benjamin Keigher, are the incorporators of the Merchants Arc Light and Power Company of Chicago. Capital stock, $30,000.

V. Warner, C. H. Moore, John Warner, and others, have incorporated the Clinton (Illinois) Electric Light, Heat and Power Company, with a capital stock of $25,000.

Adolph Graeff, Alfred Graeff, and E. Graeff, have incorporated the Chicago Electric Light Enlarging Company, of Chicago, with $5,000 capital.

Pullman, the world-wide known suburb of Chicago, is to lead the latter place in electric railway enterprise. Ground was broken on Tuesday of last week, and work is progressing rapidly, over a quarter of a mile being graded and laid before Saturday. The road is to be fully equipped and running by Nov. 1st. The work is being done by contractor Loos, who says he can complete the work much sooner if necessary, as he can easily quadruple the force at any time. The only unfortunate feature in the case is that the *quid nunc* and the newspaper fry are utterly at a loss to know what kind of a system is to be used. They have pumped, and listened and peeped, but can neither get the valves to suck, nor hear, nor see anything on which to base even a supposition. The papers and gossips are in a bad way.

Wabash, Indiana, had a suit awhile ago, instituted by Mrs. Catharine O'Brien, who by some means managed to slip on a stray telephone wire and fractured a leg. The city compromised the case for $100, and hereafter Mrs. O'B. will probably do no more slack wire performances in Wabash.

The telephone question is still on, here. Several of the aldermen are hot for a $75 rate, while others are equally certain that a higher rate is necessary to insure a fair profit on the invested capital. President Phillips of the company was before the committee on licenses a few days since, and showed that his proposition of free telephones to the corporation was equivalent to $30,000 per annum to the city. He said the company couldn't think of accepting a $75 ordinance, as the more business the company did at those rates the greater the loss would be.

There will be two—a majority and a minority report from that committee at the next council meeting.

Chairman Ernst, with Aldermen Tiedemann and Weinhardt, will recommend an ordinance similar to that passed for the Cushman, when that company was going to come in as a competitor. It may not be irrelevant to state that the Cushman somewhat resembled that historic letter that never came. The rates proposed are $90, $85 and $75, for the first, second, and third years respectively.

The minority report will be presented by Aldermen Bartels and Monear, and probably by Alderman Burke, which will not attempt to fix a rental, but in lieu thereof, propose a five per cent. tax on the gross earnings, which it is believed will be satisfactory to the company, and it is claimed will be better for the city itself.

A new skeleton has been discovered in the electrical closet. "Electric Prostration," is its name, and it is said to have originated in Creusot, France, where the most extensive electrical metallurgy in the world is carried on. The furnace gives out a light equal to about 100,000 candle power, and while the heat is not excessive, the light, it is claimed, produces a painful sensation in the throat, supplemented by irritation and inflammation of the eyes, with copious lachrymation. The skin "takes on a copper red color, and after four or five days peels off in places, and the individual is otherwise made to feel the unpleasant nature of his situation."

How natural! And how very similar the effect to that resulting from an all Saturday afternoon bath in dog days! Another and a convincing proof of the similarity between sun light and the electric light, sun heat and electric heat.

The newspaper alarmist whose article has engendered this train of thought, asks that Mr. Edison shall step to the front with some preventive, or some remedy, or both, for this awful condition of affairs. Far be it from me to usurp that gentleman's exalted position as electrical prescription clerk; but the remedies most in vogue in the days that are fled, for "sun scalds and sich," in our neck o' timber, were cold cream and a birch rod, in the hands of a dear, good mother—the first carefully used as a remedial, and the latter vigorously applied as a preventive.

There are some mooted questions in electric lighting which the National Association never hatched, although it sat down on them, as "a body might say." One of these was a question of insulation.

Professor Barrett has instituted an experiment in this line on his own hook, with the new city plant. He needed about twenty-five miles of wire, and divided up the order in such a way as to give a fair portion to each of the following companies, who will thus be thrown into a friendly and honorable competition for supremacy, "without hope of punishment or fear of reward."

Okonite, Kerite, Patterson, Cable's, Vulcanite, and Standard Underground—the latter to be furnished with Mr. E. G. Acheson's device against damage by disruptive discharges, which was so fully explained by the inventor before the recent electric light meeting in New York. C. C. H.

Chicago, Sept. 24, 1888.

Personal.

President S. A. Duncan, of the National Electric Light Association, was a New York visitor Thursday and Friday of last week.

Mr. Charles H. Gimingham, technical superintendent and manager of the Edison-Swan Electric Lighting Company of England, was a New York visitor last week, and was a guest of Mr. C. H. Barney at the Electric Club. He was greatly interested in the rapid development in electrical circles in the United States.

One of the richest men in Washington, Samuel Norment, the millionaire bank president, was once a government clerk. Another old-time department clerk who is now very rich is Mr. S. M. Bryan, who got his start by organizing the post office system of Japan. He is said to have made $100,000 a year ever since his return from Japan.—*N. Y. Evening World.*

Manufacturing Notes.

The demand for high grade platinum has compelled the Newark refiners, Messrs. Baker Co., to enlarge their works. This valuable metal is entering more and more extensively into the electrical field.

The employés of Bergman & Company, manufacturers of electroliers, were treated to the usual annual picnic, recently. Mr. T. A. Edison and Mr. S. Bergman gave the attendants several valuable prizes.

The Brush Electric Company, Cleveland, Ohio, has recently sold a large incandescent electric light plant, consisting of 1,000 incandescent lights, to the Minneapolis, Minn., Exposition. The same company have also rented the Exposition 180 arc lamps. This exposition is one of the most successful in the country.

Messrs. Hazazer & Stanley, 32 and 34 Frankfort street, New York, are doing a fine business in the manufacture of electrical apparatus. Their new catalogue presents an interesting array of goods. The work of supplying the fine residences of New York with modern electrical conveniences has been made a specialty by this firm, and the excellent character of the work done has won them many deserved compliments.

The Barcelona Exhibition.

Although it is now some 13 weeks after the official opening of the Exhibition, I regret to say that the electric lighting is still in a somewhat unfledged state. The greater portion of the main building is as yet only fitted with lamps and leads, the evening shades being left in undisturbed possession as soon as the sun sets; indeed, it is only within the last four or five weeks that any part of the Exhibition has been regularly lighted. An International Exhibition left in darkness every evening is a decided novelty in these days, and it is certainly to be regretted that the first Exhibition of the kind ever held in Spain should distinguish itself in this unhappy way. It is only fair to mention, however, that circumstances certainly do not warrant any great extravagance. The average daily attendance is only some seven or eight thousand, and, except on saints' days and Sundays, only a few dozen individuals are to be seen in the grounds after nightfall; and there seems but little hope of the number of visitors being swelled to any great extent, unless we have a rush of foreign tourists within the next few weeks. I will now give a detailed account of the electric lighting plant and the electrical exhibits of interest to be seen at the Exhibition.

The lighting of the buildings and grounds is divided between four firms, each of different nationality, so that the Exhibition is thoroughly international in this respect at any rate. The Compania Espanola de Electricidad, the only electrical engineering enterprise of importance in Spain, has 10 dynamos at work, all of native manufacture, supplying at present 120 arc lamps of 2,500 candle-power, and lighting the gardens, the fine art gallery, the science section, and the large restaurant. This is a tolerably stiff piece of work, owing to the scattered nature of the installation and the distances to be traversed by the wires. Later on this company will operate 3,400 sixteen candle-power incandescent lamps, though when I cannot say. The dynamos are driven by two powerful engines of 200 horse-power each, which also drive the machinery in the Exhibition. These engines have 23 feet fly-wheels, whose mammoth proportions greatly impress the Catalonian peasants. The Compania Espanola de Electricidad was formed in 1881, with a capital of £80,000, and has been a most successful venture. At the present moment this enterprising concern has a central lighting station at Barcelona, which supplies eighty 2,500 candle-power arcs and 500 incandescents for public lighting, and 70 arcs and 500 incandescents to private consumers. Messrs. Ganz & Company, of Budapest, have a few large and small dynamos at work, but all detailed informal tion is refused by the superintendent in charge. The Compagnie Continentale Edison makes, in my opinion, the best show of any. Their plant comprises two 200 horse-power boilers, two 150 horse-power com pound condensing engines, running at 170 revolutions a minute, and two Weyher-Richemond dynamos having an output of 800 amperes and 125 volts at 350 revolutions a minute. These two machines are probably the largest in Spain. This company has contracted to light seventy-five 750 candle-power arc lamps and 750 twenty candle-power incandescent lamps. It would be difficult to surpass these lights in brilliancy and steadiness.

The Anglo-American Brush Corporation light the ornamental fountains. Their plant comprises three high pressure boilers, of 200 total horse-power; a high pressure compound vertical Browett and Lindley engine, working at 225 revolutions, and driving a couple of 40-unit "Victoria" dynamos. An underground passage, 95 meters long, runs from the engine-house to a room under the fountain, where the colored lights are operated. The arc lamps are of special design, and are each of 4,000 candle-power. They are arranged in multiple series. The Anglo-American Brush Electric Light Corporation obtained the contract for this fountain in March, and notwithstanding the numerous difficulties which were encountered in cutting out the foundations and building the basin, the whole was put successfully to work on the evening of June 14th. The general features of the fountain are similar to those of the first example of this interesting exhibition, which was constructed under the personal superintendence of the late Sir Francis Bolton, at South Kensington. Advantage has been taken of the experience there gained, and many improvements have been introduced, which greatly enhance the effect. From the center a jet mounts to an enormous height, estimated by eye-witnesses to be 120 feet. Six jets around this rise to about 80 feet, and eight outer jets to 40 feet. These, with the sprays which surround them, are fed by very powerful steam pumps, and are illuminated by 15 projectors, throwing vertical and concentrically inclined rays of white and colored lights. The fountain has made a great sensation in Barcelona, and has been greatly praised, on account of its exceptional beauty, by members of the Exhibition Committee, who, previous to its installation, inspected some two or three similar fountains which were at work in England last year. The power employed to produce the above results is about 100 horse-power for the electric light, and from 150 to 200 horse-power in the pumps.

Messrs. R. E. Crompton & Co. (Limited) exhibit two of their well-known dynamos, only the smaller of which is at work. Messrs. Julius G. Neville & Co., of Liverpool, show a No. 10 "Castle" dynamo, driven by a Davey-Paxman engine. This machine supplies five arc lamps and 20 incandescent lamps, the light being remarkably steady. Messrs. Schuckert, of Nürnberg, have a mixed installation, 45 incandescent lamps and several arc lamps being run off the same machine. This dynamo, I may mention, is driven by an "Otto" gas engine; in fact, gas engines are very prominent in the Exhibition, and are as plentiful as blackberries.

C. Conradty, of Nürnberg, exhibits a great variety of carbons for electrical purposes; they are of all sizes and shapes, from long rods as thick as walking sticks to almost invisible filaments. The Société Anonyme de Barcelona shows some beautifully-finished incandescent lamp globes. Malagrida y Casellas, of Barcelona, exhibit a few electric light cables, but it is a poor display, more remarkable for the difficulty of obtaining information than anything novel or practical. The India-rubber, Gutta Percha and Telegraph Works Company, have a fine and unique selection of their well-known goods; while the firm of Felten & Guilleaume, of Mülheim, make a similar and equally creditable display. The Electrotechnische Fabrik, of Leipzig; the Société Générale des Téléphones, and MM. Ch. Mildé, Fils et Cie., of Paris, have exhaustive exhibits of all things appertaining to telephonic work. The Spanish official section is of great historic interest; everything relating to telegraphic and telephonic enterprise in the Peninsula, from the earliest days of their introduction, being carefully exhibited. The Barcelona Institute sends several noteworthy exhibits, amongst which I noticed a monster pile of Leyden jars of all shapes and sizes. A varied display of electro-medical apparatus is made by Messrs. Meyer & Metzer, of London. Messrs. J. E. Spagnoletti & Crookes have, at present, a very incomplete stall; they only show what they call an electrical fire announcer, about which mysterious exhibit no information is to be obtained. Finally, three large electric organs are to be seen in the Fine Art Gallery; they are made by Señor Aquilluo Amerzna, of Barcelona, and are a very praiseworthy piece of work.

These are the chief electrical exhibits at Barcelona, and I must say, considering all things, the display is by no means unworthy of the first international fair which has ever been held on Spanish soil.—*London Electrician.*

Boston's New Cable Office.

The Direct United States Cable Company has opened an independent cable office at Boston, in the Post Office building, corner Water street and Post Office Square.

From this office there are two separate and independent direct connections with England, France and Germany, thus giving the cabling public of Boston facilities for correspondence with the outer world not enjoyed by any other city in the United States,

Telephonic News

*** George H. Glass proposes to establish a telephone exchange in Durham, N. C.

*** A new telephone cable is being put down between Detroit and Windsor. It is 3,500 feet long.

*** The new telephone building in New Haven is to cost about $20,000. Work has already commenced.

*** The longest telephone line in Germany is 10 miles. Experience has shown, says an exchange, that no wire can be made strong enough to bear the gutturals of the German language further than this. It is too great a tax on its tensile strength.

*** Frank S. Pond, Woonsocket, R. I., general superintendent of the Electric Machine and Power Company's Works, has received a lucrative offer to go to the isthmus of Panama to superintend an electric station there, but has not yet decided to accept.

*** The Chicago aldermen have decided that $75 a year is rental enough for the telephone. Some of the aldermen were in favor of taxing the gross receipts 2½ per cent., but the majority favored a maximum rate of $75, and the corporation counsel was instructed to prepare an ordinance covering this decision.

*** The telephone was allowed to be used on Sunday for the first time in London a few weeks ago. The managers of the company, it is said, had grave doubts about the results of such an innovation, but the large use that was made of the privilege satisfied them. What would Americans think if they were deprived of their Sunday telephone?

Telephone Operators will get Married.

A telephone exchange is the open sesame to matrimony, remarks the Savannah *Daily Times*.

The girls seem to understand this, judging from the eager way in which they respond to advertisements for help. Marriage is still, to many, the desideratum of existence, and any opportunity that will bring them nearer to the consummation of their hopes in this respect, is not allowed to pass by if they can help it. Why the telephone office should have such an important bearing toward orange blossoms and a bridal vail no one has yet determined. The girls simply know, from the experience of those who have preceded them, that by some occult and unfathomable power the position will lead into the life partnership desired.

The managers hope and pray for the day when it will be otherwise. Now, they can hardly break a girl in before some one comes along and snaps her up, leaving them under the necessity of securing a successor, who will ultimately follow in her footsteps. This is one of the most vexatious troubles that befalls Manager R. B. Rood, of the Savannah exchange, and it causes a considerable outlay every year for advertisements. At present he has a full force but there is no telling how long it will remain intact. Four operators are required to meet the existing demands of the 400 subscribers, and as arrangements are being made to put up a new switchboard to accommodate a couple hundred new patrons, a couple of new girls are required to learn the business. One has already been secured and another one, dazzled by visions of the altar, is in prospect, while a half dozen unfortunates are lamenting their misfortune in not having secured an engagement.

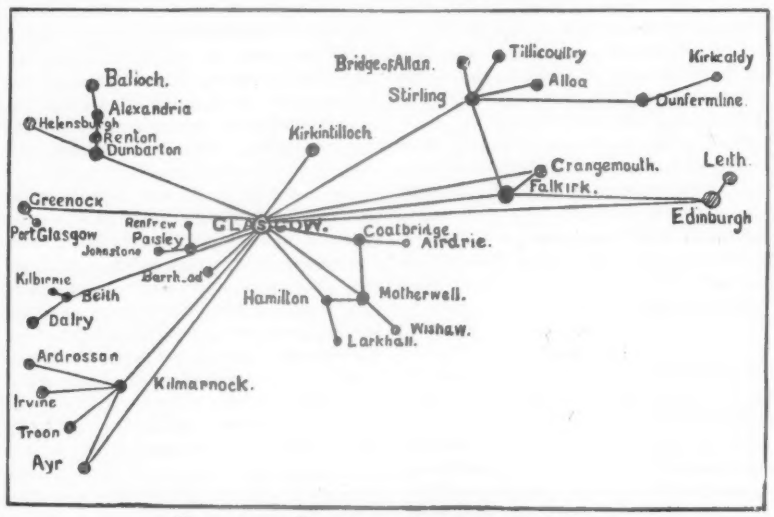
Telephone operators are generally pretty, vivacious and patient—three very desirable qualifications, indeed. Very close attention is required of them. At Savannah they work from 7.30 A. M. to 7 P. M., giving way at that hour to the night man. As the work is tedious and worrisome at the best, is is an excellent test of temperament, and it is this knowledge that probably leads men to look thereabouts for a wife.

At present the manager employs a chief operator, four day operators, one night operator, one lineman and three inspectors. The entire corps is very efficient, and complaints come less frequently than in the past. Although nearly 5,000 calls are answered every day, the few complaints that are made are usually due to the subscribers themselves, the most common cause of trouble being the calling up of a party before a conversation with another office is concluded. The call has to be obeyed, and the other man gets angry and vents his spleen on the exchange.

Telephone Systems of London, Manchester and Glasgow.

The following article appeared in the London *Financial News* of the 27th instant:

"Agreeably to your request I have examined the various systems of telephonic communication in use in England and Scotland. I have treated the three great representative centers, viz: London, Manchester and district, and Glasgow and district, separately, and compared them with each other. I have looked at the subject from a technical point of view; but, as far as possible, treated it in popular language, the intention being that your readers should be enabled to judge of the relative merits of the companies concerned, viz: the United, the Lancashire and Cheshire, and the National, and of their management.



MAP OF THE TELEPHONE SYSTEM OF GLASGOW.

"Beginning in the north, I examined first the National Company's system. This company has now in Glasgow 1,570 subscribers. The wires converge into six central exchanges, which are connected with each other by means of from eight to 25 junction wires. The wires are entirely silicium bronze of No. 18 gauge. This wire weighs only 35 pounds to the mile against 220 pounds per mile in the case of the old Post Office wires and the telephone wires commonly seen in London. The wire has the peculiar quality of returning to its normal position immediately after the snow or frost has melted off, and it contracts or expands but slightly through the action of cold or heat. Being very thin, it collects little snow, and owing to its lightness can, if broken, do little or no damage in falling. The wires are carried over the housetops by means of iron poles which rest in sockets on the roofs, and are supported by stays of twisted galvanized wire. On the principal routes five iron poles, with arms stretching across, after the pattern of a gridiron, are used. Thirty-two wires are fixed on each cross-bar, so that the five iron poles carry nearly 1,000 wires. As the distance from the exchange increases, and the number of wires becomes less, the poles are reduced to two, with 30 cross-arms carrying 10 wires each. Further on still, a single pole with 20 cross-arms carries upwards of 100 wires. The wires are attached to the arms by means of single porcelain insulators, and every joint is soldered. The use of these insulators and the soldering of the joints is of much value in producing good talking. In this connection it may be mentioned that every earth connection is also taken, regardless of distance, to the nearest water pipe and there soldered. The intercommunication, or 'switching,' is accomplished in the central offices by means of the so-called 'multiple' board system.

"Your readers are no doubt aware that a certain number of subscribers in every telephonic exchange is allocated to each of the operators in the central offices. The wires of these subscribers are all collected upon 'table,' by which means they are grouped under the control of this operator. The advantage of the 'multiple' board system is that while under the old plan great difficulty was found in practice in joining wires from table to table—that is to say, connecting with each other the groups worked by the various operators—under the new plan each wire has a connecting wire to each other wire on each table. It is difficult to convey on paper a clear idea of how this is done. The plan, though effective, is very costly, a multiple board capable of carrying 2,000 subscribers' wires requiring 400,000 feet of these connecting wires. Great quickness in service results, however, as every operator has under direct control a branch wire to the wire of every other subscriber in the central exchange. All the ringing from the exchange is accomplished by means of magneto-electric generators worked by a small turbine, the power for which is got from the ordinary water mains. Each operator has a key or switch connected with this ringing apparatus, and can thus use the current at will upon any line required. One operator is found to be able to attend in Glasgow to about 60 subscribers. As regards the subscribers' end of the wire, each subscriber is provided with a magneto ringing apparatus for the purpose of attracting the attention of the operator. The old and costly system of ringing by means of batteries has been entirely discarded.

"There is no special contrivance in Glasgow by which a subscriber can notify to the operator that his conversation is at an end. In Dundee the company has adopted a system which enables every subscriber to put himself at once—even, say, in the middle of a conversation with another subscriber—in communication with the central office. This system works well, and has been of great benefit in promoting quick service. The vexatious delays which occur when, as is too often the case, a conversation is interrupted by the central office under the impression that the interview is over, are impossible under this system. No telephonic system can be considered complete unless it embraces some contrivance for this purpose.

"Overhead cables are little used in Glasgow. In this respect Manchester, as will be seen later on, is ahead. The whole of the National Company's system, even down to the smallest exchange in a country town, is open all the year round, night and day. Glasgow is connected by means of trunk lines with all the neighboring towns of any importance; indeed, all the principal towns in Scotland can either now or will be able very shortly to communicate by telephone with each other.

"The Manchester telephonic exchange system differs in many ways from that of Glasgow. There are 1,350 subscribers, and the whole of their wires have been concentrated in one central exchange. The wires, which are hard-drawn copper of No. 18 gauge, are carried over the housetops by means of wooden standards, with two poles and 10 cross-arms, each supporting 15 wires. On the routes requiring fewer wires single wooden poles, with 10 wooden arms carrying eight wires each, are used. Single and double shackles insulate the wires. Glover's anti-induction 20-wire cable plays an important part in the outside wiring, and is found to be very successful. Along one route there is one of these lead-covered 20-wire cables one mile in length, the induction on which is said to be imperceptible. Several hundred wires are carried in this manner in many directions from the central exchange. Your readers are no doubt aware that it is owing to 'induction' that one subscriber can overhear the conversations of another. Hence the importance of avoiding it in telephone work.

"The multiple board has been introduced in Manchester with good results. The ringing from the exchange is accomplished both by means of magneto-electric machines driven by water power and also by means of batteries. A most convenient test-board receives all the wires as they come in from the roof. It is arranged so that by inserting a small plug the wire is disconnected either on entering or leaving the test-board. By this means all the wires can be at once tested, and if not found to be in working order they can be repaired, it may be before the subscriber has discovered the fault. All the neighboring towns of Lancashire and Cheshire are connected to Manchester by means of trunk lines. A special charge is made for each conversation on these trunk lines, and monthly accounts for these charges are rendered to each subscriber. In order to prevent disputes the particulars of these connections are written on a slip of paper, and this slip is placed in a small machine, which stamps on it the date and the time to a minute. Three operators attend to 200 subscribers.

"A special feature of the Cheshire Company's system is the use of what are called 'polarized indicators.' I can only hope to explain the effect of these to your readers, an idea of the mechanism not being easily conveyed. To attract the attention of the central office each subscriber has a battery of four cells, which is put in action by one of two push buttons—the one white and the other black. The white button sends a current which calls the attention of the operator in the usual way, thus notifying that the subscriber desires to be connected with some other subscriber. The operator having placed him in communication and his conversation being over, by means of the black button he is enabled to notify that the conversation is at an end, and in any case to make it clear in the central office that it is to them, if to anyone, he desires to speak. In other words, he has a similar advantage in this respect to the National Company's subscribers in Dundee. But this is gained at greater expense to the company, as the apparatus and accessories are costly and liable to get out of order.

"It now remains to consider the London system, where there are now upwards of 4,800 subscribers to the United Telephone Company's exchanges. The wires are concentrated into some 20 different centers, about half of which have between 100 to 600 subscribers each, the rest having a smaller number. The largest exchange is in Coleman street, where there are about 500 wires. Hard-drawn copper wires are now being used on new work, but the bulk of the work has been done with steel wire of No. 8 gauge, and where the largest number of wires converge they are attached to massive angle-iron tower-shaped fixtures by means of single shackles. From each corner of these fixtures two sets of upwards of 50 wires each are led off in opposite directions. Thus each of these important fixtures is designed to carry only about 400

wires. The main routes are conducted over the housetops by means of single iron poles, each having twisted wire stays to support it. The wires are arranged in one row, say, of 20 to 30 wires, reaching in a line from top to bottom of the poles, and are attached by clips and double shackles. Overhead cables are very much used, upwards of 25 of these leading away from the central city exchange. In three or more of the principal centrals multiple boards have been introduced; but in all the rest the original single-wire system remains. This, of course, entails delay, and is the cause of many of the instances of bad service which occur. The exchanges have hitherto been closed at nights and on Sundays, and are now only open in part for a continuous service. The subscribers to the London system use the original form of electrical ringing apparatus, operated by a battery—there is no separate arrangement for ringing off or calling the central office, and, in fact, no improvement of any kind has been introduced in this connection since the beginning. There has hitherto been no system of public call offices, and, with the exception of Brighton and Tilbury, no towns are connected to London by telephone. The Tilbury wire is practically disused, and the Brighton wire has been so inefficient as to lead to no practical benefit. As regards trunk wires, in fact, London may be said to be quite isolated.

"Having thus described shortly the representative centers of British telephony, and stated the plain facts in each case, let me make a short comparison of the results obtained by the companies. The question first of all arises, is it wise to concentrate all your wires into one central, as in Manchester, or to have many exchanges, as in Glasgow and London? Under existing circumstances, and unless some better system of interswitching between exchanges can be introduced, Manchester takes the lead. It must be admitted that the expense of concentrating is very great; but still, in telephony it is pre-eminently the case that the best service, although costly, is the one that will eventually pay the best. Then as to the wires; Glasgow and Manchester undoubtedly lead the way with silicium bronze and hard-drawn copper wires of a small gauge, which are better conductors, last longer, and exert only one-sixth of the strain resulting from the old-fashioned steel or iron wires so much in use in London. The next point is the fixtures on which the wires are carried. London again is found behindhand, for while Glasgow and Manchester carry from 100 to 300 wires on each main route, London, *with practically, as regards way-leaves, the same outlay, carries only* 20 *to* 30. The large angle-iron central standards in London are undoubtedly substantial, and even artistic in design, but quite unsuited for the purpose, while the only parts of the structures themselves which could conveniently and economically be used for carrying wires, viz: the flat sides, are not made use of at all!

"In the manner of the attachment of the wires to the fixtures Glasgow stands first. Single insulators, as there invariably used, have eight times the insulation resistance of the double shackle of Manchester and London, and correspondingly good talking power. In cables Glasgow is left behind.

"Descending to the switching rooms, Glasgow and Manchester are on a level footing, whilst London is just awakening to the fact that improvements upon original types exist. Manchester and Glasgow have long had an all-night and Sunday service, while London has only just begun to follow them in this. With regard to the ringing-up systems with which subscribers are provided, undoubtedly the magneto system of Glasgow is the cheapest and most efficient. Still Manchester, with the white and black buttons, has a great advantage. The London electrical ringing system is at once the most expensive and the least efficient, and has not even the redeeming feature of a special ring-off system as in Manchester. In the matter of trunk lines, Glasgow and Manchester have been at work in earnest, while London has done in effect nothing.

"With regard to the practical working it may be stated generally that London is not to be compared with the others. The causes of the delays, the induction or leakage, and the continual disconnection during conversation, which render the telephone in London comparatively useless, are to be found in the defects of the system, which, as I have shown, is in every point inferior to that in other centers."

A Bad Phonograph Under the Sofa.

"It's all over," chirped the office boy, as he swung into the room the other morning, spreading an odor of bad cigarette smoke throughout the apartment, according to the Chicago *Mail*.

"What's all over?" queried his friend, the bookkeeper, glaring up from his desk.

"Sis' sweetness on that feller on State street," replied the boy, as he tied himself into a knot in a vacant chair and picked up a morning paper.

"What's the matter?"

"Well, look here, I don't know as it's any of your business. Sis don't care much to have me talk about it before you fellows, I expect. But say, I'll tell if you don't gimme away."

"Well, I told you about the carryin' on out to our house—all about 'em breakin' down the sofa th'other night an' then layin' it onto me—didn't I? Well, the old man he wasn't satisfied with Sis' story, but he warped me, of course, just the same. The sofa was an old one, anyhow, though, an' mother said it wouldn't pay to fix it, besides its bein' out o' style fer three years back, an' she wanted a new one, anyhow. So the old man he buys a bran new one, all covered with red velvet like a car seat, you know, an' brings it out home. They put it in the parlor, and last night 'Cholly' comes, as usual.

"Him an' Sis fired me, an' I went out to the park for awhile an' then went to bed. They had a pretty long session last night an' I heard considerable rustlin' an' some laughin'. Th' ole man couldn't hear, 'cause he sleeps in the back o' the house, anyway, an' sleeps like a man that's paid his money an' wants the worth of it. Well, I heard Cholly go, after a good deal o' fussin' at the door, and then Sis come up to bed. It was most midnight, I guess.

"I come down to breakfast early, an' Sis she come down in a few minutes lookin' as cross as I ever seen her, an' that's playin' it without limit. Well, mother an' the ole man came in an' the meal went along all right till Sis begun kickin' on everything, an' especially on gettin' up so early. Well, the ole man he didn't stand it long. He looked up an' braced his elbows on the table an' says, kind o' growlin' it out: 'If you'd go to bed instead o' stayin' up all night with that infernal dude, your temper might be a little better in the morning.'

"'Robert,' says mother, 'don't use such language.'

"'Tend to your own business, Mariar,' says the ole man, gettin' hotter'n' hotter, an' mother did.

"Presently the ole man kind o' cleared up an' he turned to me, sayin' real pleasant for him: 'Willie, have you ever seen one of these new phonographs they're talkin' about so much?' I said I hadn't, an' says the ole man: 'I've been interested in 'em, an' so I bought one. I believe I left it under that new sofa last night. Go an' get it an' we'll try the blamed thing once.'

"Sis kind o' clutched the tablecloth an' gasped, an' the ole man grinned like a chessy-cat. I went an' pulled the machine out from under the sofa an' brought her in to the ole man. He set it on the table, an' Sis began to fold up her napkin. She didn't get it done quick enough, though, for the ole man give the crank a turn an' a kind o' feeble voice says:

"'Are we alone, dear?'

"Sis kind o' wilted, but the next turn brought her up again, for another sort o' pale voice, which was the dead image of hers, squeaked out:

"'Yes, Cholly, but now don't.'

"The ole man kept on turning the crank, and the sickinest lot o' gush I ever heard come out o' that box. One voice was Cholly's, but it sounded like he'd been sick for some time, and the other was just like Sis's murmur when she's in the cellar blowin' up the cook and you hear her up stairs. The first voice says: 'Oh, come on, now; don't be skittish.' an' Sis's voice says: 'Now, Cholly, quit. Some one'll hear you.' Then they kept on.

"'You shan't kiss me.'

"'Oh, yes, I shall.'

"'Now quit. I'll scream.'

"'No, you won't.'

"'Well, then, there,' and a kind of a screechy noise, like a car driver starting his horses, came out.

"'Cholly, you're the worst I ever saw.'

"'Well, what do you wiggle for?'

"'If pa ever catches you kissin' me—great heavens! What would happen?'

"'Oh, nothing, I guess. I ain't afraid of him.'

"'There, now, take your arm away.'

"'What's the matter with that arm?'

"'Oh, quit. It's too warm.'

"'It isn't too warm for me.'

"'You don't care for me, I don't believe.'

"'Don't I,' and then another of them noises came out, an' then the needle struck the end of the sheet and stopped.

"Well, say! Sis just jumped an' run, an' the old man laughed fit to kill. Then he says:

"'Mariar, don't you let that fool girl out of the house, to-day. I'll be here in time to meet Cholly myself,' an' then he kinder grins, an' says: 'I set that blamed thing for half-past eight, and thought it would catch 'em about the proper time.' Then he went out.

"I got another cup of coffee an' started to skip, myself, but I ran across Sis on the stairs, all of a tremble, an' she stopped me an' give me a quarter to tell Cholly to keep away. I reckon he will, too."

SOUTHERN ELECTRICAL NOTES.

(Special Correspondence.)

Augusta is in utter darkness; the gas and electric light plants are submerged by an overflow of the Savannah River.

When the town was roused from its slumbers at 4 o'clock Sunday morning, an awful and distressing situation was realized, which was lit up by an occasional flare of a boatman's lantern. There were cries for help in every direction, as many of the houses were four feet deep in water. All business is suspended, and many, even among the best people, are suffering and begging for help.

It is hoped that repairs can soon commence on the gas and electric light plants.

In response to a call, the citizens of Florence, S. C., met on Friday night, 7th inst., to hear information relative to the electric light plant for that city.

Major G. B. Edwards, president of the Charleston Electric Light and Power Company, explained the advantages of electric light, gave approximate cost of system, and answered a number of questions that were put to him. He estimated that $7,500 would be sufficient to put a proper plant in operation, exclusive of the motive power, and suggested that a stock company be formed to raise the capital necessary to start the enterprise.

Motion was made and carried that a committee, one from each ward, be appointed by Captain Day, to get all facts necessary, find the number of lights that can be placed, and all other information, so that it can be placed in shape before the people.

There has just been incorporated, under the State laws of North Carolina, "The Greensboro Gas & Electric Company," with a capital stock of $75,000. Messrs. Charles N. Vance, Bartlett S. Johnston and William H. Bosley are the incorporators.

Mr. George H. Glass, who has established such an efficient telephone system in Raleigh, N. C., has canvassed the town of Durham, N. C., for subscribers to a regular telephone exchange. Mr. Glass will not feel justified in establishing the exchange with less than 25 subscribers.

At Charlotte, N. C., Sunday morning, 9th of September, one of the dynamo machines at the electric light station was struck by lightning during the progress of the storm. The machines in the dynamo room were running at full speed about 1.20 o'clock, A. M., when a stroke of lightning came in on a line from Tryon street, and burned out a lightning arrester. Before the damage could be repaired, another flash came along on the same wire, ran through the burned arrester, and landed in the armature of the dynamo used for running the street lights. The armature was badly damaged, and made unfit for use, but a new one will take its place to-morrow. This is the first accident to the electric light works since its establishment in that city. EDWARD A. OLDHAM.

Charleston, S. C., Sept. 12, 1888.

—— The first legal action brought against the Edison Electric Illuminating Company of West Chester, to recover damages for injuries by the boiler explosion of last December, has been instituted by William Jones, of West Chester, through his attorney, C. W. Talbot, says the Germantown *Telegraph*. Hettie, daughter of the plaintiff, was returning from school upon the afternoon of the explosion, and while passing along Chestnut street was struck by a flying timber and instantly killed. She kept house for her father, who is a widower, and he claims damages of $10,000 for the loss of her services.

TELEGRAPHIC

.... A general strike of telegraphers in France is feared, unless existing grievances are removed.

.... The electrical works of Dorsey, Payne & Co., of Chattanooga, Tenn., were destroyed by fire recently; loss, $5,000.

.... The Louisville, St. Louis and Texas Railroad Company will soon commence building a telegraph wire along their road.

.... The Julien electric car has commenced making regular trips on the Fourth Avenue line, New York. Other cars will be added as soon as completed.

.... Bids for the San Diego (Cal.) Fire Alarm System were received from Geo. P. Low, agent for the Gamewell system; $5,550, $3,825, and $3.425. From the San Diego Street Telegraph Company, $3,750.

.... It is reported from Michigan that the Tamarack and Osceola Copper Manufacturing Company will build at once an eight-furnace smelting plant at Dollar Bay, where the product of the Tamarack, Osceola, and Kearsarge mines, amounting to 1,000 tons per month, will be smelted.

... One of the most competent all-round telegraph operators in the country is said to be Henry Siegfried, who is employed in the main Western Union office in this city. For several years he was the fastest receiver in the Buffalo office, and since he has been transferred here he has won new laurels. He recently performed the extraordinary feat of receiving two messages at the same time. He also on one occasion sent two separate messages at the same time, one with each hand.

.... As referring to a substance now so much used for electrical purposes, the following description of an American mica quarry may be of interest:—One of the best American quarries is some two miles from Rumney, on the Boston-Montreal line. It lies rather high up, and consists of two gullies some 35 ft. deep, with sides of almost pure mica bedded between feldspar and quartz. The mineral occurs in veins from 1 ft. to 5 ft. thick, and is got by blasting in pieces from 20 lb. to 40 lb. each. These are then broken up and removed to the works, where they are split up, shaped to wooden templates by shears, and packed in 1 lb. bundles. The finer material is split by female labor in another workshop. The mica is sent out wholesale in 100 lb. boxes, of an average value of $500. The works show as curiosities a sheet of mica 2 ft. by 1½ ft., perfectly transparent, and also a six-sided crystal of nearly pure beryl, weighing 80 lb. The scrap mica and cuttings are ground up to powder with oil, and used as a lubricant.

.... The Panama canal hospitals, says a correspondent, are the most extensive and best equipped of any seen by one within the tropics. I include Mexico, Central and a part of South America and the West Indies. The system of hospitals, their fittings, medical staff, etc., are of the highest order. Their Panama system alone cost over $3,000,000 to build. The company's hospitals, sanitarium, etc., with attendance, etc., up to last year cost over $12,000,000. This seems incredible but it is quite true. The isthmus of Panama is and always will be a pestilential and death-dealing center, constantly added to by the systematic unburial of the dead year by year, and the liberating of untold millions of germs of small pox and yellow fever. Remember, Panama is the gate to the Pacific. She ships disease up and down the coast as regularly as she ships goods. I state what I know, not what I think. Epidemic after epidemic already have resulted from this more then criminal disturbing of its dead in such a climate. In our English islands such vile practices are unknown.

Adams, Mass., is to have an electric street railroad.

The Sprague Company is very busy just now, and its factory is working to its maximum capacity. They have at present 27 roads in operation or in process of construction in different parts of the country, and are constantly making additions to this number.

Alexander Kempt, the representative of the Brush Electric Company, Chicago, Ill., has sold during the past season a large number of electric light plants for steam boats on the Mississippi and its tributaries. Some of the Brush plants used on the Mississippi River steam boats have been in use for a number of years.

A dispatch from Mansfield, Ohio, says: "A big deal in the Mansfield Electric Street Railway Company was consummated to-day. The road, which has about five miles of track in operation and five cars in use, was built by Neftel & Oothont, of New York City, about a year ago, and they have owned a controlling interest in it. They have sold this to Mr. Van Renssellaer, Jr., of New York; J. T. Sill, of Detroit, and S. V. R. Townsend, of Chicago. The former is now president."

It is a trifle over a year since the Baxter motor was first placed on the market. Within that short space of time it has found its way in nearly every State of the Union, as may be seen from the following list of States: Massachusetts, Maine, New York, Oregon, Texas, Michigan, Ohio, Illinois, Nebraska, Colorado, Connecticut, Kansas, Montana, Minnesota, Nevada, Pennsylvania, Wisconsin, Tennessee, Louisiana, New Jersey, Virginia, Rhode Island, California, Georgia, Mississippi, Delaware, Maryland, Missouri. This introduction has been rapidly pushed since then, and it is probable that now it may be found in every State of the Union.

The Thomson-Houston Electric Railway Work.

The president and directors of the West End Street Railway Company, of Boston, have been investigating with great care different methods of street car propulsion, including the cable and various electrical systems. They have made it a point to visit principal cities in this country where these systems are in operations, and have made a rigid examination. They have evidently been governed by the desire to make the best possible move for the improvement of street railway facilities in Boston.

For some time the West End Company have been negotiating with the Thomson-Houston Company. Mr. Whitney and his Board have greatly admired this company's road at Crescent Beach, where, during the season, hardly a scheduled trip was missed. This fact, they think, gives pretty good assurance of the reliability of the system. Negotiations culminated September 14th, when Mr. Whitney signed a contract with the Thomson-Houston Company.

They are to begin at once the construction of a line from Harvard Square, Cambridge, to Arlington, to run by the "overhead" system. The cars will be running within 60 days, and very soon afterward a line will probably be running to Bowdoin Square, Boston proper.

The company has at present 19 roads in successful operation. They are at Scranton, Pa. (3); Revere, Mass. (2); Syracuse, N.Y.; Washington, D. C.; Ansonia, Ct.; Binghamton, N. Y.; Detroit, Mich.; Jamaica, N. Y.; Port Huron, Mich.; St. Catherines, Ont.; Wheeling, W. Va.; Appleton, Wis.; Dayton, Ohio; Fort Gratiot, Mich.; Lima, Ohio; and Windsor, Ont.

There are also roads in process of construction at North Adams, Mass.; Wichita, Kan.; Des Moines, Iowa; Omaha, Neb.; Lynn, Mass.; Danville, Va.; Hudson, N. Y.; Seattle, Wash. Ter.; and Bangor, Me.

The Baxter Electric Motor Works, Baltimore.

The new works of the Baxter Electric Manufacturing and Motor Company, Baltimore, were auspiciously opened Wednesday evening, September 19th. There was a large number present, some 1,500 in all, including several from other cities. The occasion was called the "opening levee," and was a reception given by the managers to every employé of this large and rapidly growing motor company.

There are two new buildings, the main one, where the motors will be manufactured, being 320 feet in length by 75 feet in width. The other building, which is nearly as large, is intended for boiler room, engine room, blacksmith shop, pattern shop, brass foundry, etc. The company from the time of its organization two years ago has occupied two factories, on the corner of Monument and Buren streets and Monument and Constitution streets. When the increased demand for the motors necessitated the removal of the factories to larger quarters the immense buildings on Biddle street were erected.

Mr. James B. Sanner, an employer of the company, delivered a short address, in which he spoke of the uniformly kind treatment the men had always received, and referred in highly complimentary terms to Mr. Morrison and Mr. D. E. Evans, the superintendent.

Mr. J. F. Morrison, the managing director, responded and gave a short history of the company. He said (after pleasantly referring to the ladies who were out in great numbers) that it was an unique assembly, in that it had brought together in a sociable way the employer and the employé, and he was proud to be the guest of the workmen whose skill had done so much in bringing the motor to the perfection which was acknowledged on all sides. Two years ago, when the first small motors were produced, it was thought their field would be limited to run sewing machines, but it was soon found there was a larger, broader field, and the Baxter Company now produced motors of from ½ to 200 horse power which, to-day, were superseding all other power in mechanical and manufacturing business. It was found that just such power was needed to run elevators, and to-day he could point with pride to motors which had displaced the cumbersome plant previously used. It was found that something more was needed, a generator, which would furnish the electrical energy needed to drive these motors economically. Such a machine was produced, and to-day the demand for them proves the necessity of the new Baxter generator.

Mr. Morrison referred to the officers of the company and others who had furnished the capital necessary to exploit so great an undertaking, but he said it is, after all, to the genius of Mr. Wm. Baxter that we are indebted for the magnificent organization, for the splendid structure in which he spoke—to *him*—who had the inventive mind to conceive and the brain to perfect, and he was proud to say that to-day the Baxter Company had active representatives in 28 States—from Maine to California—from the Lakes to the Gulf.

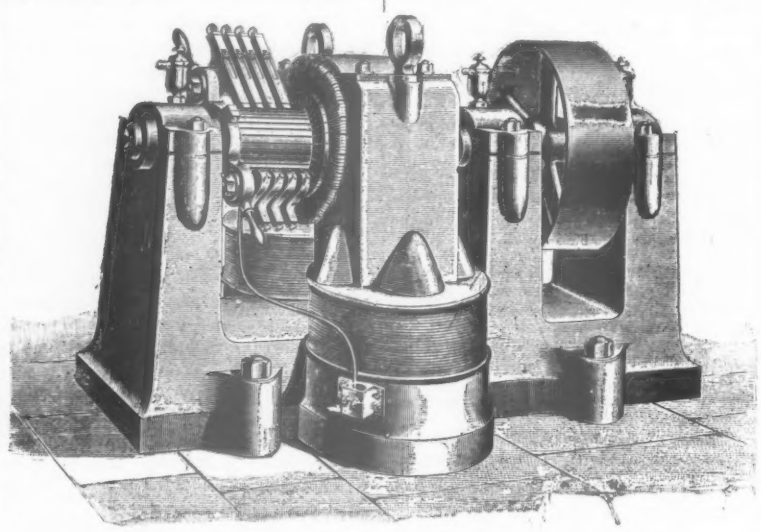
The Hon. F. C. Latrobe, Mayor of Baltimore, was then introduced. He congratulated the citizens of Baltimore that an establishment had been planted in their midst which was to give employment to so many people, and spoke of the advantages of the city as a manufacturing center, and concluded by saying that all the thousands of dollars worth of machinery to go into the building would not be assessed for or pay one cent of taxes.

The arrangements for the hop were under the charge of Mr. D. E. Evans, and were perfect. The rooms were decorated with flags and plants in profusion, and showed the excellent taste of Mrs. D. E. Evans.

The music and supper were furnished by Mr. Morrison, and the evening was one which will be long remembered by all participating.

The reception committee consisted of: Hon. F. C. Latrobe, Hon. James Hodges; Benson M. Greene (president), L. Strouse (vice-president), James D. Mason (treasurer), W. H. Harding (secretary), J. F. Morrison (managing director), A. B. Proul (assistant manager), all of the Baxter E. M. & M. Co.; S. Rosenthal, W. V. Logan, B. F. Smith, W. Baxter, Jr., Hon. Isidor Rayner, Hon. H. Welles Rusk, E. M. Schryver (president of Police Commissioners), John Gill, J. Q. Robson, A. J. Carr, D. Howard Tuxworth, W. Harris, M. Granadier, W. F. D. Crane, P. O. Keilholtz, Dr. G. A. Liebig, Jr., David E. Evans.

The REVIEW congratulates the Baxter people on the success that has attended their work in the electrical field, and hopes to see their prosperity continue and increase.



A NEW DYNAMO—COVENTRY.

The Coventry Dynamo.

Messrs. Stafford & Eaves, of the Volt Works, Coventry, are the manufacturers of the dynamo illustrated on this page. It is described in our London namesake as follows:

The armature is of the ring type, built up of thin discs of charcoal sheet iron .05 inch thick; the discs are insulated with varnished paper; they are supported on phosphor bronze radial arms in such a manner that it is impossible for them to come loose, however great the strain to which they may be put. In all sizes of these machines there is only one layer of wire on the armature; the makers do not depart from this rule even for an E. M. F. of 3,000 volts. In the medium and large sizes, driving horns or projections are provided for carrying the armature wires through the resistance of the magnetic field.

The brushes are of a special form, having circular and pressure adjustment, the motion of the brush being parallel to its length, so that the angle of contact with the commutator is always the same. A large number of brushes of various sizes and material have been tried, but the three following have given the best results—thin copper strips alternated with copper wire, soft brass wire, and wire gauze. A large surface of brush is employed, and the pressure being light, a set of brushes will, with care, last three or four years of ordinary lighting work. The commutators are of ample size; the bars are cast from a special alloy of great durability; the sections of the commutator are insulated with mica.

Sprague Road at Minneapolis.

The Sprague Electric Railway and Motor Company has, since the last issue of this paper, been awarded another and very important railway contract. This is with President Lowry, of the Minneapolis (Minn.) Lyndale Avenue Street Railway, and calls for the equipping of that important street railway line.

The cars will run from Bridge Square to the end of the line, a distance of 14,000 feet, or over 2½ miles. The power will be furnished by the Edison Electric Light & Power Company, whose plant is now building in the rear of the Lumber Exchange.

Before making any contract for electrical equipment, the directors of this road visited a number of the different roads in operation in this country, and inspected the working of each system.

They decided upon the Sprague system, and that they do not look upon failure as a possibility is shown by the large amount of money which they will put into the plant. The cars to be equipped will be new, and will be finer than any cars now running in Minneapolis. They will all be brilliantly lighted by electricity.

The electric cars will all be running by January 1st, 1889, and the Sprague people guarantee their successful operation.

As stated before, the power will be furnished by the Edison Light & Power Company, of Minneapolis. Mr. Lowry has a provisional contract with the company to furnish power for the entire system.

The construction of the plant is rapidly going forward, and it will be running by December 15th. It will be one of the most important industries in Minneapolis, and will furnish power not only for the street railway system, but for a great part of the manufacturing establisments in the city, as it is more economical than steam power. The building will be 11 stories high, and fire-proof. Its construction is such that the power capacity can be increased—the idea being that the company will be able to furnish all the power used in the city if necessary. The capital stock is $500,000, and some of the wealthiest men in the city, including T. B. Walker, C. H. Chadbourne, S. G. Cook, H. C. A. Keyyel, and C. H. Maxey, are interested in the enterprise.

The Tudor Accumulator.

It will be remembered that in our issue of 15th June we gave an abstract of a very favorable report by Prof. Kohlrausch on the above cell. Since then we see from the *Zeits. für Electrotechnik*, Vienna, the learned professor has tried the effect of a full charge in the wrong direction. The cell appears to have stood this rather severe ordeal in a very satisfactory manner, none of the oxides dropping off, and the liquid remaining perfectly clear the whole time. At the end of second hour's charge the E. M. F. of the cell had dropped to zero; after the third hour it was — 1.7, then — 2.34, — 2.20, and — 2.15. After the 4th, 5th and 6th hours, and after 10 hours — 2.12. It then received 105 ampere hours in the right direction (the normal charge being 50 ampere hours); after which it gave only 15 per cent. less return than the normal. It was then recharged with 75 ampere hours, or 25 ampere hours excess, and all effect of the reversal was found to have disappeared.—*London Electrician.*

In the case of an alternating current motor, such as the Rechniewski, with a Gramme commutator, the machine is of course self-starting, though not self-regulating *per se*. It is, however, worth while to inquire what will happen if, the motor being at rest, the current is switched on at a time when the brushes happen to rest on two adjacent commutator bars. It is obvious that these two coils, being short circuited, will have a tremendous current generated by induction from the core, quite sufficient in a very brief time to burn them out; in fact, the remaining coils act as the primary, and these two as secondary coils of a transformer. On the other hand, it seems most probable that the armature will begin to move before there is time for any mischief to be done—more especially as the effect of the two coils, being out of circuit at the moment, will diminish the impedance of the armature.—*London Electrician.*

A New Electric Lighting Station at Providence.

The Narragansett Electric Lighting Company has begun the construction of a new station at the foot of Elm street on the river front, where a lot of land 200 by 300 feet has been bought with a wharf frontage of 200 feet, says the Providence *Journal*. The contracts are not all concluded yet, but the foundations are in for the dynamo room, 60 by 200 feet, a single story structure to be built of brick with brown stone trimmings and an iron roof. The pile foundations are also down for the stack, which will be a 14-foot flue, octagon in section and 200 feet high. The boiler room will be in a separate building across a driveway, and coal pockets will be built over the boiler house into which coal may be delivered from vessels with but a single handling. The premises are arranged so as to allow of duplication of both the power and dynamo houses, if necessary, and the lot will afford opportunity for the establishment of one of the largest stations in the country if needed. The company has not yet decided upon the change in its steam plant save in a general way, but Mr. Perry stated at the recent Electric Light Convention in New York that the Company intended to abandon the high pressure engine and to use a compound engine and surface condenser. It is intended to arrange the station so as to get a uniform load while operating the engine. This company has used the Armington & Sims engines, and has a number of them now at work in its dynamo room. To find out what was being accomplished with the high-speed engine, and to ascertain what benefit would be derived from adopting another type of engine, the company engaged Mr. John T. Henthorn to see what the steam plant was doing in every day practice, and his investigations showed a horse power for about $\frac{62}{100}$ths of a cent per hour. Mr. Perry states that the company will get into the new station in the course of three or four months.

The Ball Electric Light Company.

Among their late sales the Ball Electric Light Company, of New York City, report the following :

100 arc lights and 200 incandescents, through their Mexican agents, I. Aguirre & Bros., for Toluca, Mex.

35 arc lights (increase) to the National Worsted Mills, Providence, R. I.

70 arc lights to W. A. Walton & Co., Wood River Junction, R. I.

Hartford Electric Light Company, Hartford, Conn., 200 arc lights (increase).

Jersey City Electric Light Company, Jersey City, N. J., 50 arc lights (increase).

Novelty Electric Company, Philadelphia, Pa., 25 arc lights.

Clarksburg Electric Light Co., Clarksburg, W. Va., 70 arc lights.

Pennock Bros., Minerva, O., 25 arc lights.

J. L. Bueron, Quezaltenango, C. A., 210 arc lights and 350 incandescents.

Muncie Electric Light and Power Company, Muncie, Ind., 25 arc lights.

Consolidated Coal and Iron Company, Wellston, O., 26 arc lights.

Ball Electric Light Company, of Cincinnati, Cincinnati, O., 30 arc lights (increase.)

Manton Mills, Manton, R. I., 70 arc lights (increase).

The Wisdom of Headquarters.

[Boston *Commercial Bulletin*.]

The National Electric Light Association has ceased to be a nomadic body convening at various large cities from year to year, and has finally settled down. It has been voted to establish permanent headquarters at New York. This seems to be a very wise decision. The association is too influential and represents a branch of natural science practically applied too broad and interesting not to be permanently fixed. A capable electrical engineer will be put in charge of the headquarters.

—— The Duluth, South Shore & Atlantic R. R. Company, of Marquette, Mich., have, during the past week, increased their arc light plant by purchasing a number of arc lamps from the Brush Electric Company, of Cleveland, Ohio.

The Perfect Control of Dynamo Belts.

At the Convention of the National Electric Light Association, recently held at the Hotel Brunswick, much thought and attention was given the subject of controlling dynamo and other swift running belts.

The invention, of one of the members, Mr. U. H. W. Schenck, of this city, a belt holder and shifter—(a working model with some recent improvements)—was on exhibition and caused much favorable comment from prominent representatives of electric light companies present. The inventor informs us that during the past three months the machines have been thoroughly tested on slow speeds as well as with very wide and

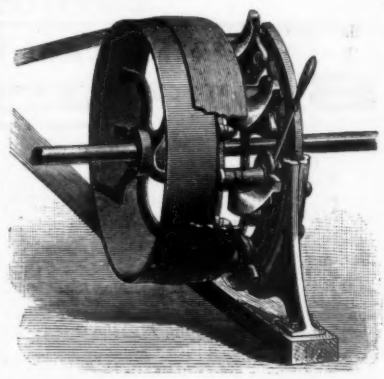


FIG. 1.—SCHENCK BELT HOLDER.

swift running belts, and in all cases has more than fulfilled expectations. It has the advantage that warping is out of the question, and being made of steel and iron the durability and efficiency is greatly increased. We give herewith a description and illustration of this ingenious device, and we think our readers will find both of interest.

Fig. 1 represents the belt being shifted from the holder to the pulley. The shifting of the belt from the pulley to the holder is accomplished by means of an ordinary shipping rod (shown in Fig. 2).

Fig. 2 is described as follows :

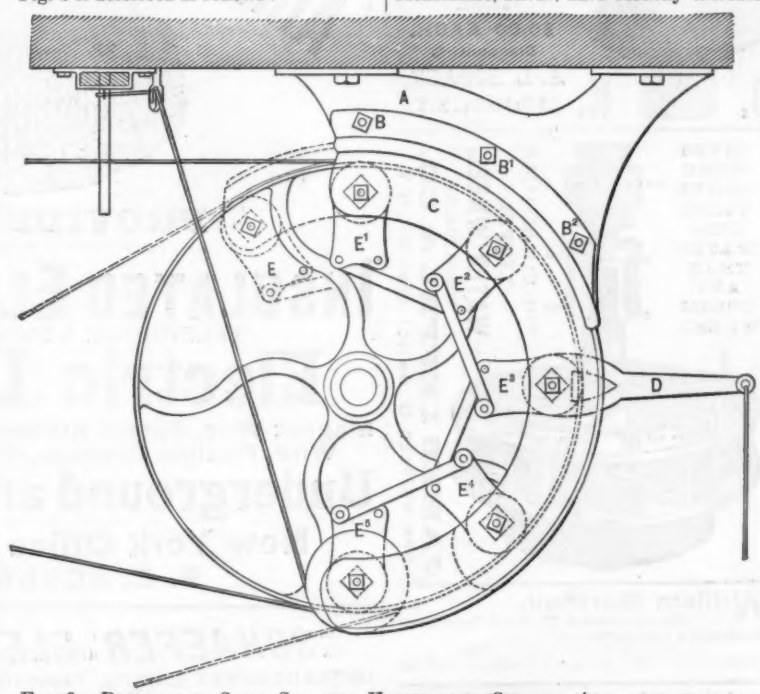


FIG. 2.—DIAGRAM OF SAME, SHOWING HOLDER AND SHIFTER ATTACHED TO THE CEILING.

The part of the device associated with the pulley is of the same radius, semi-circular in form, and occupies a position to the pulley corresponding with that position in which the belt rests. *A* represents a pendant bracket secured to the ceiling or other suitable support. The lower edge of the bracket is formed in a segmental line. *B*, B^1, B^2 are bolts running through a removable segmental plate, and securing it to the lower edge of the bracket. *C* is a sustaining plate formed in the shape of a sector, and is adjustable in foot *A*. Another sector-shaped plate is placed parallel with plate *C*, and at a distance from it equal to the width of belt used. Between these plates are placed webbed spiral shifters. Between webs of spirals, rolls are placed, making a perfectly frictionless surface for the belt to be received upon.

The spiral shifters are moved in unison by locking devices, *E*, connected with each other by links which are operated by a lever, *D*, projecting from any one of the locking devices. When the lever is lowered, the belt is shipped on to a holder by a common shipping rod, shown in Fig. 2. The belt, when on the holder, becomes an idle belt, and the tension is much lessened. By raising the lever the belt is deflected to the pulley by the action of the spirals, and at the same time the tension is restored.

The operation is so effectively done that there is absolutely no shock or jar, and in electrical work no slackening up of dynamo is required, points readily seen to be of great value in electric light plants.

It is claimed that in many electric light plants this device can in a short time make a very large actual saving in power, time, and wear on dynamos and belts. Among the later shipments to the west are several for pulleys 60" and 72" diameter, while larger sizes are in course of construction. The low cost and perfect working readily demonstrate the value for purposes mentioned, and the testimonials and duplicate orders make a strong endorsement.

—— A Pittsburgh paper says that the Westinghouse Electric Company has received an order from England for a dynamo and 5,000 lamps, and another from Germany for 5,000 lamps. A representative of the company is now on the ocean *en route* to Great Britain in the expectation of getting a number of large orders.

—— The Marysville Electric Light Company, Marysville, Kansas, have recently purchased a large arc and incandescent electric light plant from the Brush Electric Company, Cleveland, Ohio. The installation of the plant is about completed. All the lights originally ordered have been placed, and the company have ordered an additional number of arc lights from Cleveland.

—— The Menominee Electric Light Co., Menominee, Mich., have recently increased their electric light plant by purchasing a number of 2,000 c. p. arc lamps from the Brush Electric Co., Cleveland, Ohio. The Menominee Company report that they have a large and flourishing arc and incandescent electric light central station filled with Brush apparatus.

—— Alexander Kempt, Chicago agent of the Brush Electric Company, has recently sold two incandescent electric light plants ; one to the Mishawaka Woolen Mfg. Co., of Mishawaka, Ind., consisting of a 150 light incandescent dynamo, with a full complement of lamps ; the other, a duplicate plant, to Studebaker Bros. Mfg. Co., of South Bend, Ind. The Studebaker Bros. Mfg. Co. have a very complete arc and incandescent electric light plant, consisting of Brush apparatus. Some of their dynamos have been in operation for seven or eight years, and are to-day working as well as at the start.

ELECTRIC LIGHT NEWS

—— E. D. Steele, of High Point, N. C., is negotiating to establish an electric light plant.

—— The Bay Minette Cotton Manufacturing Company, of Mobile, Ala., will put in electric lights.

—— An electric light company has been organized at Columbia, Tenn., by McDonnell, Dew and others.

—— The Stewart Paper Manufacturing Company, of Conyers, Ga., will erect a large electric lighting plant.

—— The De Soto Oil Company, of Memphis, Tenn., will put an electric light plant into their cotton seed oil mills.

—— W. J. Kincard, of Griffin, Ga., is contemplating the erection of an electric plant for lighting the streets of the town.

—— The new Providence (R. I.) electric light station is said to have greater floor space than any station in the United States.

—— The Prospect Park Board, Brooklyn, are discussing the question of lighting the Park either by the incandescent or arc electric light.

—— Alexander Kempt, Chicago agent of the Brush Electric Company, has recently sold a small arc light plant to the steamer "Pauline," Hannibal, Mo.

—— Manager Reed of the Burlington, Iowa, Edison Electric Company, has resigned, and a meeting of the directors will be held soon to elect a successor.

—— T. H. Smith, Jamestown, N. Y., has recently increased his electric light plant by purchasing 12 arc lamps from the Brush Electric Company, Cleveland, Ohio.

—— The new electric light company at Gardner, Mass., commenced to erect poles last week. They will have the Thomson-Houston system, and have already a contract for lighting the streets.

—— The *Globe-Democrat* says the lighting of the St. Louis Exposition is almost perfect. Arc lamps are used on the outside of the Olive street front, and incandescent lamps inside of the building.

—— The new central station of the Boston Electric Lighting Company on Atlantic avenue will be of brick, and three stories high. There will be 52 dynamos with a capacity of 3,000 arc lights.

—— The Salem (Mass.) Electric Light Company has purchased the Perley wharf, and will erect works of double the present size and capacity. Electric light stations with water frontage appear to be the style in New England.

—— The *Standard*, of Buenos Ayres, quotes from the REVIEW the editorial of a year ago relating to electric light investments, and speaks approvingly of the efforts of Mr. C. V. Boisot, the electric light advocate of that South American city.

—— J. E. Ridall, representing the Brush Electric Company in Pittsburgh, has recently sold an electric light plant to the Pittsburgh Traction Company, consisting of a 30 light 2,000 candle power arc dynamo with a full complement of lamps.

—— The Leavenworth Water Works Company, Fort Leavenworth, Kan., have recently increased their incandescent electric light plant by purchasing a new incandescent dynamo from the Brush Electric Company, Cleveland, Ohio.

—— Edward W. Tisdall, representing the Brush Electric Company in Philadelphia, has recently sold a complete incandescent electric light plant consisting of 225 incandescent lights to the Ellis & Lessig Steel & Iron Company, Pottstown, Pa.

ELECTRICAL PATENTS

(Copies of any Patents in the following List will be sent to any address on receipt of twenty-five cents.)

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING SEPTEMBER 10, 1888.

389,601 Mechanical telephone system; Abner M. Rosebrugh, Toronto, Ont., Canada.

389,626 Electric time recorder; Aloys Weraching Brooklyn, N. Y.

389,635 Pressure indicator and recorder; William H. Bristol, Hoboken, N. J.

389,638 Electrical distribution by secondary batteries; Thomas P. Conant, New York, N. Y., assignor to the Electrical Accumulator Company of New York.

389,640 Rheotome mechanism for medical batteries; Harry B. Cox, Cincinnati, Ohio, assignor to the H. B. Cox Electric Company, New Haven, Conn.

389,658 Armature winding for dynamo electric machines; Walter H. Knight, New York, N. Y.

389,676 Cell for electric batteries; Sylvanus L. Trippe, St. Louis, Mo.

389,678 Fire alarm system; Thomas G. Turner, New York, N. Y.

389,692 System of electrical gas lighting and extinguishing; Harry T. Downs, Saratoga Springs, N. Y.

389,696 Fire escape; Jacob M. Fink, New York, N. Y.

389,729 Electrical heating apparatus; John Wiest, York, Pa.

389,752 Conductor for dynamo electric machines; Edward F. H. H. Lauckert, Charlton, County of Kent, England, assignor to Siemens & Halske, Berlin, Germany.

389,758 Ground detector for electric light circuits; Albert W. Morrell, Indianapolis, Ind., assignor to the Jenney Electric Company, same place.

389,764 Electro therapeutic cap; Nathaniel P. Rutter, Waltham, Mass.

389,779 Direct welding dynamo electric machine; Elihu Thomson, Lynn, Mass.

389,781 Process of electrolyzing sewage and sea water; William Webster, Jr., Lee Park, Lee, County of Kent, England.

389,795 Means for distributing electric energy; Sebastian Z. de Ferranti, London, England.

389,799 Automatic circuit maker and breaker; Willard W. Eastabrook, Boston, Mass.

389,813 Dynamo electric machine; Thomas H. Hicks, Detroit, Mich.

389,822 Electric Railway system; John D. Nicholson and William J. McElroy, Pittsburgh, Pa., and Thomas J. McTighe, New York, N. Y.

389,836 Means for distributing electric energy; Sebastian Z. de Ferranti, London, England.

389,839 Telegraphic call for messengers, etc.; Benjamin Dubinski, St. Louis, Mo., assignor to Charles P. Budd, Lambert J. Kiser and William J. Kiser, same place.

389,853 Safety apparatus for elevators; Charles E. Ongley, New York, N. Y.

389,857 Electric fare register; Edward A. Scales, Lowell, assignor of one-half, by mesne assignments, to Charles A. Kellogg, Newton, Mass.

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One	50 Volts	10	to 15	Amperes	Capacity.
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"	125 "	4	to 5	"	or
	250 "	3½	to 4	"	Capacity.

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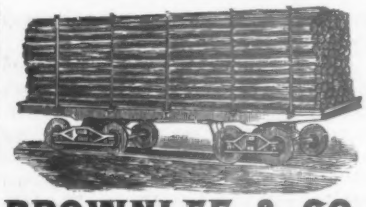

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NEW YORK OFFICE, 63 WALL STREET.
New York, August 21st, 1888.

A. F. MASON, Esq.,
SIMPLEX ELECTRICAL CO.,
Boston, Mass.

Dear Sir:
I have been using the Simplex Wire on a large portion of our lines in Richmond, Va., for the past five months. I have taken daily tests of the insulation during that time. The longest single circuit I have is about five miles, and at no time has the insulation test ever been less than one megohm. I cannot speak too highly of the wire or its insulation. A large portion of it has been run through foliage and trees in the streets, and upon examination a few days ago I failed to find any place where the wire has been abraded by coming into contract with the branches of trees. My instrument does not measure over one meghom, and I cannot tell how much higher the insulation may have measured. One megohm on wires in circuit is enough for me.

Yours very truly,
W. H. COLE, *Superintendent.*

THOMSON-HOUSTON ELECTRIC CO.,
AUGUSTA, GA.
August 12th, 1888.

Dr. A. F. MASON,
SIMPLEX ELECTRICAL COMPANY,
328 Washington St., Boston, Mass.

Dear Sir:
We are using in our arc-lighting circuits about twenty (20) miles of your Simplex T. Z. R. wire.
We have feund the insulation a most perfect protection against moisture and the abrasion of small tree limbs.
Have used your wire in our station, for running through trees, on buildings and porches, under mouldings, etc., and through cellars, and we have never been able to discover a "ground" upon any circuit since our plant was put into operation.

Very truly yours,
JOHN H. WATERMAN.

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